

# **GOULDS PUMPS**

## **Installation, Operation and Maintenance Instructions**



**Model 4150**



**ITT**

# FOREWORD

This manual provides instructions for the Installation, Operation, and Maintenance of the Goulds Model 4150. This manual covers the standard product plus common options that are available. For special options, supplemental instructions are supplied. **This manual must be read and understood before installation and start-up.**

The design, materials, and workmanship incorporated in the construction of Goulds pumps makes them capable of giving long, trouble-free service. The life and satisfactory service of any mechanical unit, however, is enhanced and extended by correct application, proper installation, periodic inspection, condition monitoring and careful maintenance. This instruction manual was prepared to assist operators in understanding the construction and the correct methods of installing, operating, and maintaining these pumps.

**Goulds shall not be liable for physical injury, damage, or delays caused by a failure to observe the instructions for installation, operation, and maintenance contained in this manual.**

**Warranty is valid only when genuine Goulds parts are used.**

Use of the equipment on a service other than stated in the order will nullify the warranty, unless written approval is obtained in advance from Goulds Pumps.

Supervision by an authorized Goulds representative is recommended to assure proper installation.

Additional manuals can be obtained by contacting your local Goulds representative or by calling 1-800-446-8537.

## **THIS MANUAL EXPLAINS**

- **Proper Installation**
- **Start-up Procedures**
- **Operation Procedures**
- **Routine Maintenance**
- **Pump Overhaul**
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- **Ordering Spare or Repair Parts**

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## IMPORTANT SAFETY NOTICE

*To: Our Valued Customers*

User safety is a major focus in the design of our products. Following the precautions outlined in this manual will minimize your risk of injury.

ITT Goulds pumps will provide safe, trouble-free service when properly installed, maintained, and operated.

Safe installation, operation, and maintenance of ITT Goulds Pumps equipment are an essential end user responsibility. This *Pump Safety Manual* identifies specific safety risks that must be considered at all times during product life. Understanding and adhering to these safety warnings is mandatory to ensure personnel, property, and/or the environment will not be harmed. Adherence to these warnings alone, however, is not sufficient — it is anticipated that the end user will also comply with industry and corporate safety standards. Identifying and eliminating unsafe installation, operating and maintenance practices is the responsibility of all individuals involved in the installation, operation, and maintenance of industrial equipment.

Please take the time to review and understand the safe installation, operation, and maintenance guidelines outlined in this Pump Safety Manual and the Instruction, Operation, and Maintenance (IOM) manual. Current manuals are available at [www.gouldspumps.com/literature\\_ioms.html](http://www.gouldspumps.com/literature_ioms.html) or by contacting your nearest Goulds Pumps sales representative.

**These manuals must be read and understood before installation and start-up.**

For additional information, contact your nearest Goulds Pumps sales representative or visit our Web site at [www.gouldspumps.com](http://www.gouldspumps.com).

# SAFETY WARNINGS

Specific to pumping equipment, significant risks bear reinforcement above and beyond normal safety precautions.

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 **WARNING**

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A pump is a pressure vessel with rotating parts that can be hazardous. Any pressure vessel can explode, rupture, or discharge its contents if sufficiently over pressurized causing death, personal injury, property damage, and/or damage to the environment. All necessary measures must be taken to ensure over pressurization does not occur.

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 **WARNING**

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Operation of any pumping system with a blocked suction and discharge must be avoided in all cases. Operation, even for a brief period under these conditions, can cause superheating of enclosed pumpage and result in a violent explosion. All necessary measures must be taken by the end user to ensure this condition is avoided.

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 **WARNING**

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The pump may handle hazardous and/or toxic fluids. Care must be taken to identify the contents of the pump and eliminate the possibility of exposure, particularly if hazardous and/or toxic. Potential hazards include, but are not limited to, high temperature, flammable, acidic, caustic, explosive, and other risks.

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 **WARNING**

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Pumping equipment Instruction, Operation, and Maintenance manuals clearly identify accepted methods for disassembling pumping units. These methods must be adhered to. Specifically, applying heat to impellers and/or impeller retaining devices to aid in their removal is strictly forbidden. Trapped liquid can rapidly expand and result in a violent explosion and injury.

ITT Goulds Pumps will not accept responsibility for physical injury, damage, or delays caused by a failure to observe the instructions for installation, operation, and maintenance contained in this Pump Safety Manual or the current IOM available at [www.gouldspumps.com/literature](http://www.gouldspumps.com/literature).

# SAFETY

## DEFINITIONS

Throughout this manual the words **WARNING**, **CAUTION**, **ELECTRICAL**, and **ATEX** are used to indicate where special operator attention is required.

**Observe all Cautions and Warnings highlighted in this Pump Safety Manual and the IOM provided with your equipment.**



### **WARNING**

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

**Example:** Pump shall never be operated without coupling guard installed correctly.



### **CAUTION**

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

**Example:** Throttling flow from the suction side may cause cavitation and pump damage.




### **ELECTRICAL HAZARD**

Indicates the possibility of electrical risks if directions are not followed.

**Example:** Lock out driver power to prevent electric shock, accidental start-up, and physical injury.









When installed in potentially explosive atmospheres, the instructions that follow the Ex symbol must be followed. Personal injury and/or equipment damage may occur if these instructions are not followed. If there is any question regarding these requirements or if the equipment is to be modified, please contact an ITT Goulds Pumps representative before proceeding.

**Example:**  Improper impeller adjustment could cause contact between the rotating and stationary parts, resulting in a spark and heat generation.














## GENERAL PRECAUTIONS



### WARNING

A pump is a pressure vessel with rotating parts that can be hazardous. Hazardous fluids may be contained by the pump including high temperature, flammable, acidic, caustic, explosive, and other risks. Operators and maintenance personnel must realize this and follow safety measures. Personal injuries will result if procedures outlined in this manual are not followed. ITT Goulds Pumps will not accept responsibility for physical injury, damage or delays caused by a failure to observe the instructions in this manual and the IOM provided with your equipment.

General Precautions		
WARNING		NEVER APPLY HEAT TO REMOVE IMPELLER. It may explode due to trapped liquid.
WARNING		NEVER use heat to disassemble pump due to risk of explosion from tapped liquid.
WARNING		NEVER operate pump without coupling guard correctly installed.
WARNING		NEVER run pump below recommended minimum flow when dry, or without prime.
WARNING		ALWAYS lock out power to the driver before performing pump maintenance.
WARNING		NEVER operate pump without safety devices installed.
WARNING		NEVER operate pump with discharge valve closed.
WARNING		NEVER operate pump with suction valve closed.
WARNING		DO NOT change service application without approval of an authorized ITT Goulds Pumps representative.
WARNING		<p><b>Safety Apparel:</b></p> <ul style="list-style-type: none"> <li>♦ Insulated work gloves when handling hot bearings or using bearing heater</li> <li>♦ Heavy work gloves when handling parts with sharp edges, especially impellers</li> <li>♦ Safety glasses (with side shields) for eye protection</li> <li>♦ Steel-toed shoes for foot protection when handling parts, heavy tools, etc.</li> <li>♦ Other personal protective equipment to protect against hazardous/toxic fluids</li> </ul>
WARNING		<p><b>Receiving:</b></p> <p>Assembled pumping units and their components are heavy. Failure to properly lift and support equipment can result in serious physical injury and/or equipment damage. Lift equipment only at specifically identified lifting points or as instructed in the current IOM. Current manuals are available at <a href="http://www.gouldspumps.com/literature_ioms.html">www.gouldspumps.com/literature_ioms.html</a> or from your local ITT Goulds Pumps sales representative. Note: Lifting devices (eyebolts, slings, spreaders, etc.) must be rated, selected, and used for the entire load being lifted.</p>
WARNING		<p><b>Alignment:</b></p> <p>Shaft alignment procedures must be followed to prevent catastrophic failure of drive components or unintended contact of rotating parts. Follow coupling manufacturer's coupling installation and operation procedures.</p>



<b>General Precautions</b>		
<b>WARNING</b>		Before beginning any alignment procedure, make sure driver power is locked out. Failure to lock out driver power will result in serious physical injury.
<b>CAUTION</b>		<b>Piping:</b> Never draw piping into place by forcing at the flanged connections of the pump. This may impose dangerous strains on the unit and cause misalignment between pump and driver. Pipe strain will adversely effect the operation of the pump resulting in physical injury and damage to the equipment.
<b>WARNING</b>		<b>Flanged Connections:</b> Use only fasteners of the proper size and material.
<b>WARNING</b>		Replace all corroded fasteners.
<b>WARNING</b>		Ensure all fasteners are properly tightened and there are no missing fasteners.
<b>WARNING</b>		<b>Startup and Operation:</b> When installing in a potentially explosive environment, please ensure that the motor is properly certified.
<b>WARNING</b>		Operating pump in reverse rotation may result in contact of metal parts, heat generation, and breach of containment.
<b>WARNING</b>		Lock out driver power to prevent accidental start-up and physical injury.
<b>WARNING</b>		The impeller clearance setting procedure must be followed. Improperly setting the clearance or not following any of the proper procedures can result in sparks, unexpected heat generation and equipment damage.
<b>WARNING</b>		If using a cartridge mechanical seal, the centering clips must be installed and set screws loosened prior to setting impeller clearance. Failure to do so could result in sparks, heat generation, and mechanical seal damage.
<b>WARNING</b>		The coupling used in an ATEX classified environment must be properly certified and must be constructed from a non-sparking material.
<b>WARNING</b>		Never operate a pump without coupling guard properly installed. Personal injury will occur if pump is run without coupling guard.
<b>WARNING</b>		Make sure to properly lubricate the bearings. Failure to do so may result in excess heat generation, sparks, and / or premature failure.
<b>CAUTION</b>		The mechanical seal used in an ATEX classified environment must be properly certified. Prior to start up, ensure all points of potential leakage of process fluid to the work environment are closed.
<b>CAUTION</b>		Never operate the pump without liquid supplied to mechanical seal. Running a mechanical seal dry, even for a few seconds, can cause seal damage and must be avoided. Physical injury can occur if mechanical seal fails.
<b>WARNING</b>		Never attempt to replace packing until the driver is properly locked out and the coupling spacer is removed.
<b>WARNING</b>		Dynamic seals are not allowed in an ATEX classified environment.
<b>WARNING</b>		DO NOT operate pump below minimum rated flows or with suction and/or discharge valve closed. These conditions may create an explosive hazard due to vaporization of pumpage and can quickly lead to pump failure and physical injury.

General Precautions		
WARNING		Ensure pump is isolated from system and pressure is relieved before disassembling pump, removing plugs, opening vent or drain valves, or disconnecting piping.
WARNING		<b>Shutdown, Disassembly, and Reassembly:</b> Pump components can be heavy. Proper methods of lifting must be employed to avoid physical injury and/or equipment damage. Steel toed shoes must be worn at all times.
WARNING		The pump may handle hazardous and/or toxic fluids. Observe proper decontamination procedures. Proper personal protective equipment should be worn. Precautions must be taken to prevent physical injury. Pumpage must be handled and disposed of in conformance with applicable environmental regulations.
WARNING		Operator must be aware of pumpage and safety precautions to prevent physical injury.
WARNING		Lock out driver power to prevent accidental startup and physical injury.
CAUTION		Allow all system and pump components to cool before handling them to prevent physical injury.
CAUTION		If pump is a Model NM3171, NM3196, 3198, 3298, V3298, SP3298, 4150, 4550, or 3107, there may be a risk of static electric discharge from plastic parts that are not properly grounded. If pumped fluid is non-conductive, pump should be drained and flushed with a conductive fluid under conditions that will not allow for a spark to be released to the atmosphere.
WARNING		Never apply heat to remove an impeller. The use of heat may cause an explosion due to trapped fluid, resulting in severe physical injury and property damage.
CAUTION		Wear heavy work gloves when handling impellers as sharp edges may cause physical injury.
CAUTION		Wear insulated gloves when using a bearing heater. Bearings will get hot and can cause physical injury.

## ATEX CONSIDERATIONS and INTENDED USE

Special care must be taken in potentially explosive environments to ensure that the equipment is properly maintained. This includes but is not limited to:

1. Monitoring the pump frame and liquid end temperature.
2. Maintaining proper bearing lubrication.
3. Ensuring that the pump is operated in the intended hydraulic range.

The ATEX conformance is only applicable when the pump unit is operated within its intended use. Operating, installing or maintaining the pump unit in any way that is not covered in the Instruction, Operation, and Maintenance manual (IOM) can cause serious personal injury or damage to the equipment. This includes any modification to the equipment or use of parts not provided by ITT Goulds Pumps. If there is any question regarding the intended use of the equipment, please contact an ITT Goulds representative before proceeding. Current IOMs are available at [www.gouldspumps.com/literature\\_ioms.html](http://www.gouldspumps.com/literature_ioms.html) or from your local ITT Goulds Pumps Sales representative.

All pumping unit (pump, seal, coupling, motor and pump accessories) certified for use in an ATEX classified environment, are identified by an ATEX tag secured to the pump or the baseplate on which it is mounted. A typical tag would look like this:



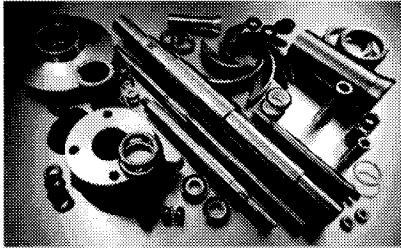
The CE and the Ex designate the ATEX compliance. The code directly below these symbols reads as follows:

- II = Group 2
- 2 = Category 2
- G/D = Gas and Dust present
- T4 = Temperature class, can be T1 to T6 (see Table 1)

<b>Code</b>	<b>Max permissible surface temperature °F (°C)</b>	<b>Max permissible liquid temperature °F (°C)</b>
T1	842 (450)	700 (372)
T2	572 (300)	530 (277)
T3	392 (200)	350 (177)
T4	275 (135)	235 (113)
T5	212 (100)	Option not available
T6	185 (85)	Option not available

The code classification marked on the equipment must be in accordance with the specified area where the equipment will be installed. If it is not, do not operate the equipment and contact your ITT Goulds Pumps sales representative before proceeding.

## PARTS



The use of genuine Goulds parts will provide the safest and most reliable operation of your pump. ITT Goulds Pumps ISO certification and quality control procedures ensure the parts are manufactured to the highest quality and safety levels.

Please contact your local Goulds representative for details on genuine Goulds parts.

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# GENERAL INFORMATION

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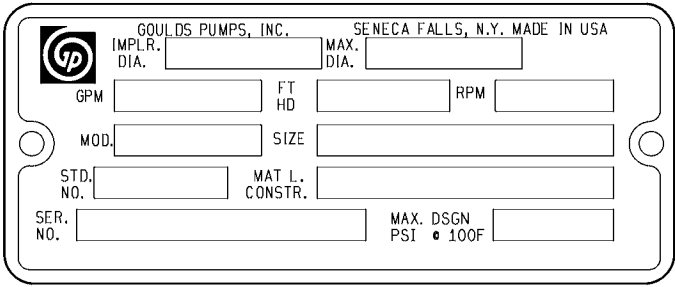
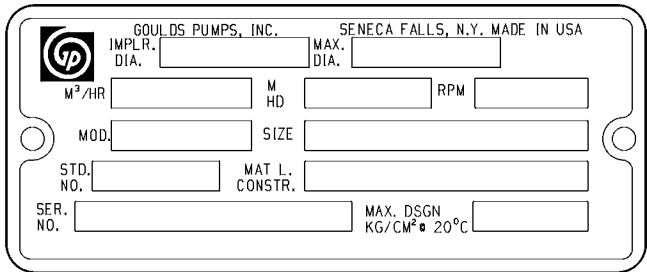
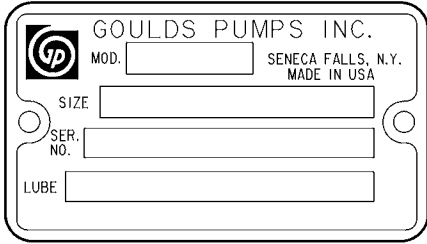
## PUMP DESCRIPTION

The Goulds Model 4150 is a non-metallic, end suction, horizontal pump designed to handle corrosive fluids. The pump meets ANSI/ASME B73.1 dimensions, except for the 4x4-10 and the 10x12-16 sizes. The 1.5x3-8 is an A50 (group 2) while the rest of the 3196 family uses a group 1 frame for the 1.5x3-8, with an AB designation. The 4150 pump covers a wide range of customer applications in most of Goulds' core and secondary markets. Because of its ANSI conformance, the Model 4150 is interchangeable with existing metal ANSI pumps. Each element of the pump's design provides the user with an optimal approach to combating the inevitable effects of corrosion.

# NAMEPLATE INFORMATION

Every pump has two Goulds nameplates that provide information about the pump. The tags are located on the casing and bearing frame.

When ordering spare parts, you will need to identify pump model, size, serial number, and the item number of required parts. Information can be taken from the pump casing tag. Item numbers can be found in this manual.

Description	Fig. No.	Example
<p><b>Pump Casing Tag</b> - provides information about the pump's hydraulic characteristics. Note the format of the pump size: Discharge x Suction - Nominal maximum Impeller Diameter in inches. (Example: 2x3-8)</p> <p>(Figs. 1 &amp; 2)</p>	<p><b>Fig. 1</b> <b>English</b></p>	 <p>The English nameplate includes fields for: IMPLR. DIA., MAX. DIA., GPM, FT HD, RPM, MOD., SIZE, STD. NO., MAT L. CONSTR., SER. NO., and MAX. DSGN PST @ 100F.</p>
	<p><b>Fig. 2</b> <b>Metric</b></p>	 <p>The Metric nameplate includes fields for: IMPLR. DIA., MAX. DIA., M<sup>3</sup>/HR, M HD, RPM, MOD., SIZE, STD. NO., MAT L. CONSTR., SER. NO., and MAX. DSGN KG/CM<sup>2</sup> @ 20°C.</p>
<p><b>Bearing Frame Tag</b> - provides information on the lubrication system used (Fig. 3)</p>	<p><b>Fig. 3</b></p>	 <p>The Bearing Frame Tag includes fields for: MOD., SIZE, SER. NO., LUBE, and the text: GOULDS PUMPS INC., SENECA FALLS, N.Y., MADE IN USA.</p>

# RECEIVING THE PUMP

Inspect the pump as soon as it is received. Carefully check that everything is in good order. Make notes of damaged or missing items on the receipt and freight bill. File any claims with the transportation company as soon as possible.

## STORAGE REQUIREMENTS

**Short Term:** (Less than 6 months) Goulds normal packaging procedure is designed to protect the pump during shipping. Upon receipt, store in a covered and dry location.

**Long Term:** (More than 6 months) Preservative treatment of bearings and machined surfaces will be required. Rotate shaft several times every 3 months. Refer to driver and coupling manufacturers for their long term storage procedures. Store in a covered dry location.

***NOTE:** Long term storage treatment can be purchased with the initial pump order or can be applied to pumps already in the field that were not treated at the factory. This service can be supplied by contacting your local Goulds sales representative.*

## HANDLING



### WARNING

*Pump and components are heavy. Failure to properly lift and support equipment could result in serious physical injury or damage to pumps. Steel toed shoes must be worn at all times.*

Use care when moving pumps. Lifting equipment must be able to adequately support the entire assembly. Hoist bare pump using a suitable sling, through the adapter and under the bearing frame (Fig. 4). Baseplate mounted units should be strapped under the baseplate or under the motor and the pump adapter.



### WARNING

*Refer to the Installation section of this manual for detailed instructions for lifting a Polyshield® ANSI Combo with installed equipment. Never lift a Polyshield® ANSI Combo with pump and motor mounted on the base.*

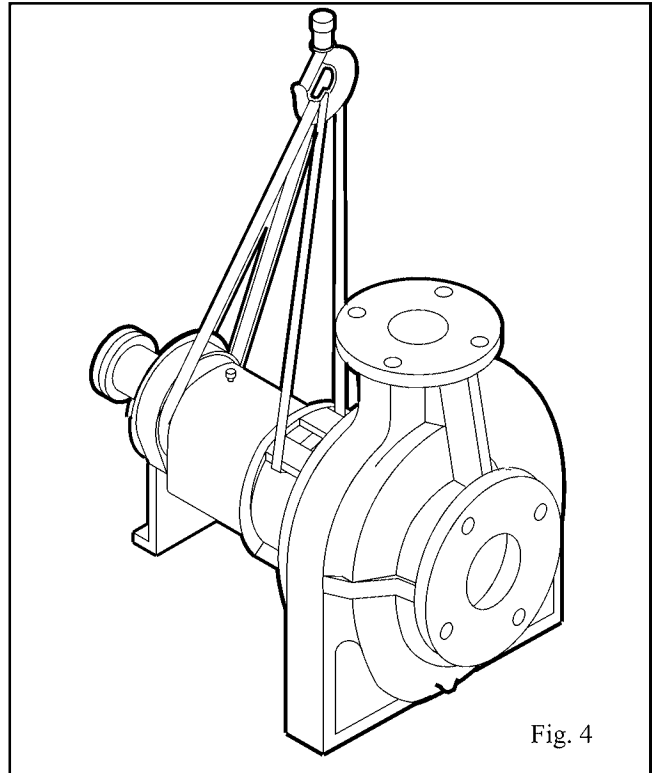


Fig. 4





# INSTALLATION

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## BASEPLATE INSPECTION

1. Remove all equipment.
2. Completely clean the underside of baseplate. It is sometimes necessary to coat the underside of the baseplate with an epoxy primer. This may have been purchased as an option.
3. Remove the rust preventative solution from the machined pads with an appropriate solution.

## SITE / FOUNDATION

A pump should be located near the supply of liquid and have adequate space for operation, maintenance, and inspection.

Baseplate mounted pumps are normally grouted on a concrete foundation, which has been poured on a solid footing.

The foundation must be able to absorb any vibration and to form a permanent, rigid support for the pumping unit. The location and size of the foundation bolt holes are shown on the outline assembly drawing, provided with the pump data package.

Foundation bolts commonly used are sleeve type (Fig. 5) and J type (Fig. 6). Both designs permit movement for final bolt adjustment.

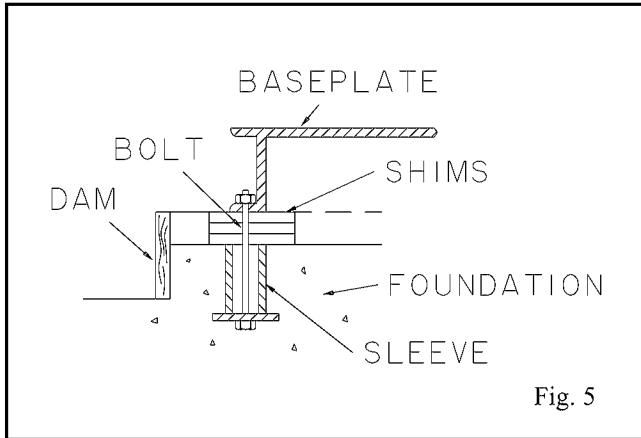


Fig. 5

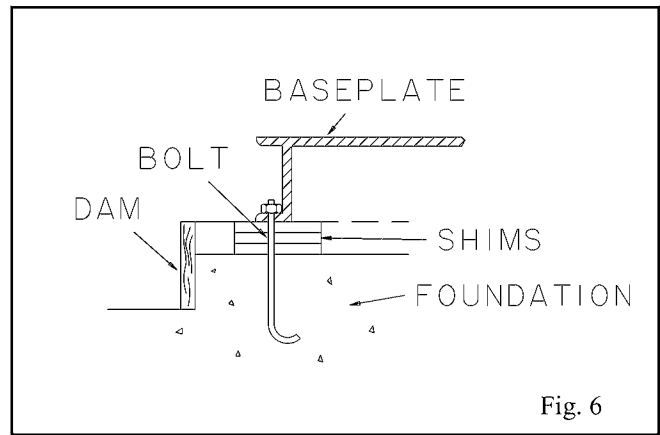


Fig. 6

1. Inspect foundation for dust, dirt, oil, chips, water, etc. and remove any contaminants. Do not use oil-based cleaners as grout will not bond to it.
2. Prepare the foundation in accordance with the grout manufacturer's recommendations.

## LEVEL BASEPLATE

### CAST IRON/PERMABASE™/FAB. STEEL

1. Place two sets of wedges or shims on the foundation, one set on each side of every foundation bolt. The wedges should extend .75 in. (20mm) to 1.50 in. (40mm) above foundation, to allow for adequate grouting. This will provide even support for the baseplate once it is grouted.
2. Remove water and/or debris from anchor bolt holes/sleeves prior to grouting. If the sleeve type bolts are being used, fill the sleeves with packing or rags to prevent grout from entering.

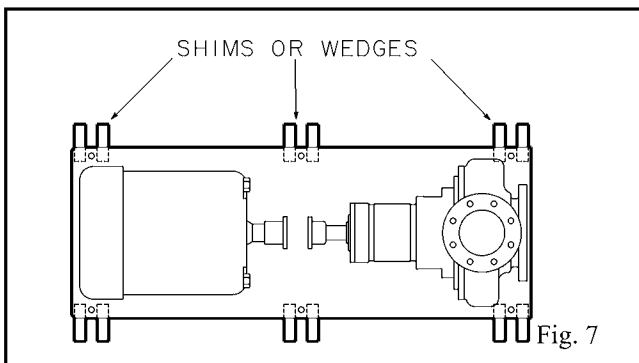


Fig. 7

3. Carefully lower baseplate onto foundation bolts.
4. Level baseplate to within .125 in. (3.2mm) over length of the baseplate and to within .088 in. (1.5mm) over the width of the base by adjusting wedges.

5. A level should be placed across the pump mounting pads and the motor mounting pads.
6. Hand tighten the bolts.

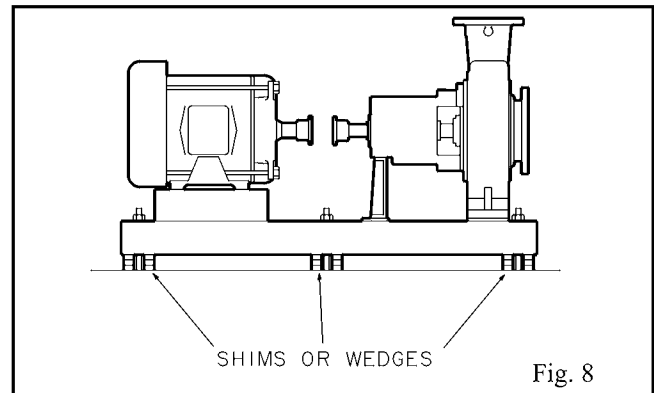
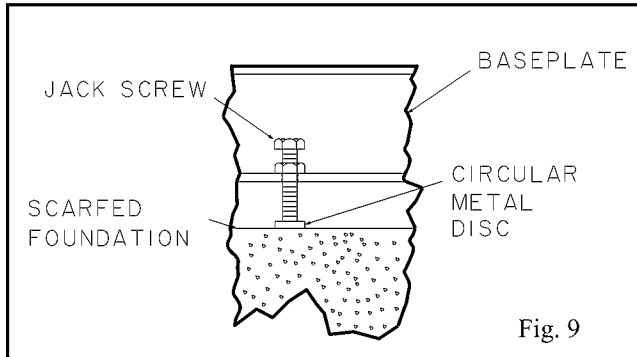


Fig. 8

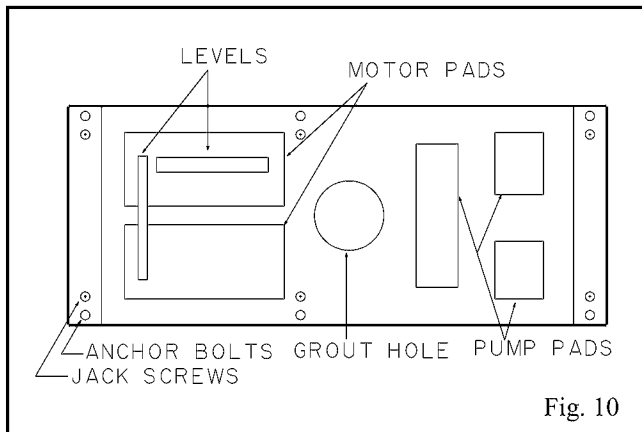
### FEATURE FAB. STEEL / ADVANTAGE BASE (BASEPLATES PROVIDED WITH VERTICAL LEVELING ADJUSTERS)

1. Coat the jack screws with an anti-seizing compound to allow for easy removal after the grout has been cured.
2. Cut round circular plates from bar stock to set the jack screws on. The edges of the plates should be chamfered to reduce stress concentrations.

- Set the baseplate on the foundation and use the four corner jack screws to raise the baseplate off the foundation 0.75" to 1.5". The two center jack screws should not be touching the foundation.

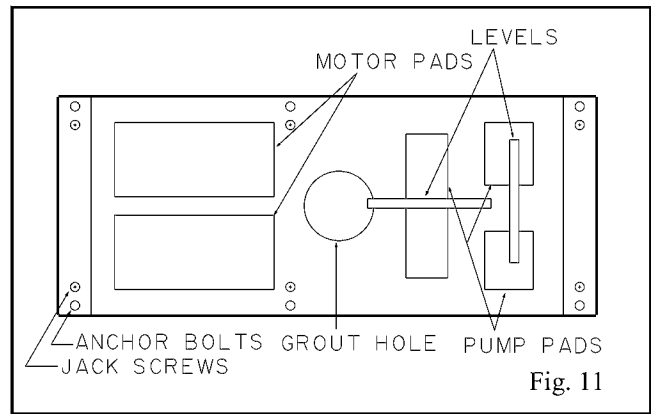


- Place two machinist levels on the motor pads, one lengthwise on a single motor pad, and another across the ends of both motor pads (Fig. 10).



**NOTE:** When using a machinist level, it is important that the surface being leveled is free of all contaminants, such as dust, to ensure an accurate reading.

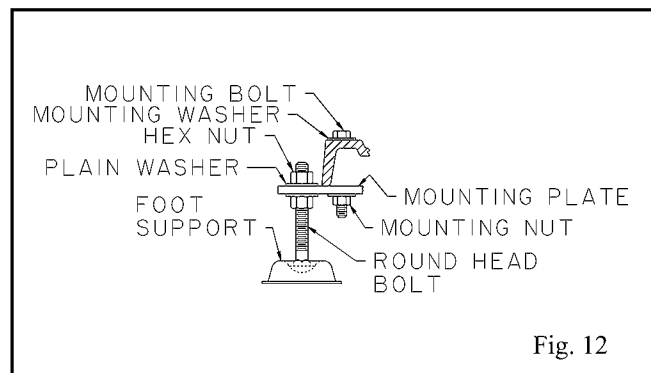
- Level the motor pads as close to zero as possible, in both directions, by adjusting the four jack screws.
- Next, turn down the center jack screws so that they are resting on their metal discs on the foundation.
- Place the two levels on the pump pads, one lengthwise on a single pump pad, and another across the middle of both pump pads (Fig. 11).
- Level the pump pads as close to zero as possible, in both directions, by adjusting the jack screws.
- Install the anchor bolts until they are hand tight.
- Return the levels to the motor pads and check the level measurements.



- Adjust the jack screws and anchor bolts, if necessary, until all level measurements are within the design requirements of 0.002 in./ft.
- When taking readings, center the level over the pad being measured.

**NOTE:** The Baseplate Leveling Worksheet provided may be used when taking readings.

## Stilt Mounted



- Raise or support the baseplate above the foundation or floor.
- Determine the desired baseplate height above the floor referenced to the stilt mounting flange.
- Set the bottom adjusting nuts and jam nuts on each stilt to the desired height.
- Insert a washer between the bottom adjusting nut and the baseplate.
- Install each stilt, holding it in place with another washer and the top adjusting nut. Finish by installing the top jam nut.
- Once all four stilts have been installed, lower the unit making sure each stilt bolt head settles into its floor cup.

- Level the baseplate while making final height adjustments. Adjust the baseplate height by loosening the top jam nut and adjusting nut. Change the height by moving the lower adjusting nut. When the baseplate is level, tighten the top adjusting nuts and then snug the lower and upper jam nuts.

**NOTE:** Suction and discharge piping must be individually supported. The stilt mounted baseplate is not designed to support any static pipe loads.

## Spring Mounted

- Raise or support the baseplate above the foundation or floor. Be sure to allow enough room under the baseplate to install the spring assemblies.
- Set the bottom adjusting nuts on each spring stud to the desired height.
- Insert a washer between the bottom adjusting nut and the spring follower. Install a spring and another follower. Install this subassembly from the bottom of the baseplate.
- Install the upper half of the spring assembly consisting of a follower, a spring, another follower, and a flat washer. Now install the top adjusting nut and jam nut. Tighten finger tight.
- Repeat steps 1 thru 4 for all the spring assemblies.
- Once all the springs have been installed, lower the unit on to the foundation pads.

**NOTE:** The foundation pads are supplied by the customer. They are to be 16-20 micro-inch surface finish 316 stainless steel plate.

- Level the baseplate while making final height adjustments. Adjust the baseplate height by loosening the top jam nut and adjusting nut. Change the height by moving the lower adjusting nut. When the baseplate is level, tighten the top adjusting nuts just enough to make sure the top springs are not loose in their followers and then snug the lower and upper jam nuts.

**NOTE:** Suction and discharge piping must be individually supported. The spring mounted baseplates are designed to support piping loads developed by thermal expansion only.

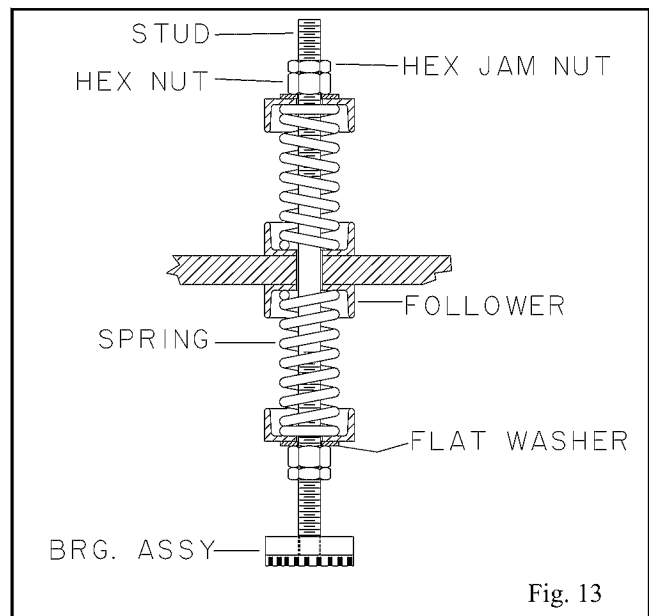


Fig. 13

# Polyshield® ANSI Combo

## Installation, Operation, and Maintenance Instructions

### Safety Considerations

Several important general precautions are listed below:

1. Do not remove the Polyshield® ANSI Combo from its shipping pallet until you are ready to hoist it onto its location.
2. Do not subject the Polyshield® ANSI or Custom Combo to rough handling or unnecessary mechanical shock.
3. Do not attempt to lift the Polyshield® ANSI Combo by any means other than that which is prescribed in these procedures.
4. Do not use hammer blows or other impact loading to adjust the positioning of the Polyshield® ANSI Combo. Do not pry against the Polyshield® mounting block when moving the motor during shaft alignment.
5. Do not attempt to transport, handle, or install a Polyshield® ANSI Combo when ambient temperature is below -50° F (-45° C).
6. Do not operate a pump installed on a Polyshield® ANSI Combo at process fluid temperatures in excess of 300° F (150° C) with polymer mounting pads and 500° F with alloy mounting pads unless prior approval from ITT Industries is obtained in writing.

**NOTE:** Always coordinate installation activity with operations personnel, and follow all plant safety requirements and applicable safety and health laws, directives and regulations.

### Overview



#### WARNING



#### CAUTION

*Observance of proper handling procedures during installation is extremely important to prevent damage to the Polyshield® ANSI Combo. While polymer concrete possesses inherent high strength, subjecting it to impact or bending loads through rough handling or improper lifting or mounting may result in irreparable damage to the Polyshield® ANSI Combo as well as damage to the mounted equipment or injury to personnel.*

### Application

The polymer concrete material used in the manufacture of the Polyshield® ANSI Combo has been formulated for application in a wide range of corrosive fluid handling services. The material is not, however, universally corrosion resistant. A comprehensive corrosion guide is available. (Refer to Pricebook Page 766.7. It is strongly recommended that this bulletin be reviewed prior to specifying or installing a Polyshield® Product.

The Polyshield® ANSI Combo is also suitable for application in a wide range of fluid process temperatures, specifically, -50° F to 300° F (-45° C to 150° C). Depending on the configuration of the pump that is to be mounted on the Polyshield®, fluid process temperature in excess of 300° F (150° C) may be permissible. Contact your ITT Industries Goulds Pumps representative for assistance in determining acceptability of a specific application.

### Storage

This section addresses the storage procedures for the Polyshield® ANSI Combo only. When storing Polyshield® ANSI Combos and pump assemblies, it is important that the proper storage procedures for the pump be observed as well. Refer to the Installation, Operation and Maintenance Instructions (IOM) for the particular Goulds pump that is mounted on your Polyshield® product.

Polyshield® normal packaging is designed to protect the Polyshield® ANSI Combo during shipment and handling from the time it is manufactured at the factory to installation at the end user's jobsite. If the Polyshield® Combo is to be stored for a period of time prior to installation, it is recommended that the following procedures be followed:

- a. Leave the Polyshield® ANSI Combo strapped to its wooden shipping pallet.
- b. Place the pallet on a solid, dry, level surface in a location where the ANSI Combo cannot be struck by passing fork trucks, falling objects, etc. Make sure the pallet does not rock.
- c. Do not stack heavy objects on top of the Polyshield® ANSI Combo.

- d. If the Polyshield® ANSI Combo is to be stored in an outdoor location, cover the Polyshield® completely with a tarpaulin or dark plastic sheeting to prevent UV degradation of the surface.

**NOTE:** UV degradation (bleaching) of the polymer concrete is the normal result of exposure to sunlight. This phenomenon is purely a visible change in the color of the material, which in no way compromises the performance or corrosion resistance characteristics of the Polyshield®.



**WARNING**

Do not attempt to stand a Polyshield® on its end to make more efficient use of storage space. Neither the Polyshield® Combo nor the strapping that holds the Polyshield® Combo to its wooden pallet have been designed for vertical storage. Severe personal injury or death, as well as irreparable damage to the Polyshield® Combo may result if the Combo tips over.

**Lifting Polyshield® Combo Units and Polyshield® Combo / Pump Assemblies**



**CAUTION**

Polyshield® units should be transported via fork truck to the area of their intended installation on the wooden pallets on which they were shipped. Never transport a Polyshield® unit over a long distance or over rough terrain while suspended from slings.

Only trained personnel should do lifting. Pumps and motors often have integral lifting eyes or eye bolts. These are intended for use in lifting the individual pieces of equipment. Do not use these features to lift a Polyshield® Combo / pump assembly.

**Lifting**

The following procedures are recommended for lifting Polyshield® ANSI Combo units:

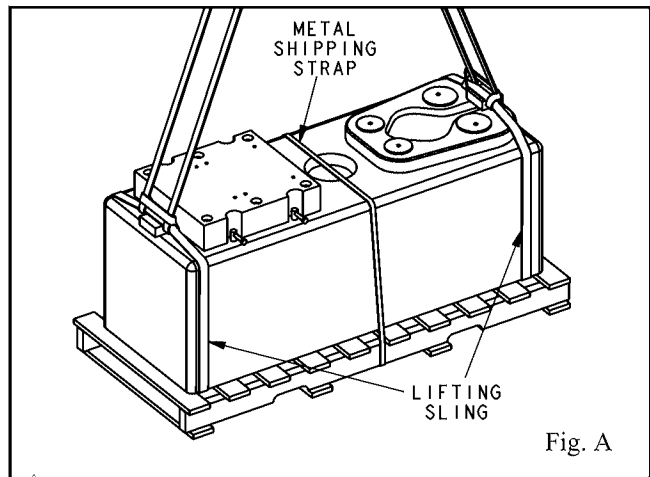
**Polyshield® with no mounted equipment:**



**WARNING**

Do not install eyebolts in the Polyshield® thread inserts for the purpose of lifting the base. This practice imposes lateral loads on the inserts — which they were not designed to withstand.

Remove the metal shipping straps that hold the Polyshield® unit to the wooden pallet. Slip slings under each end of the Polyshield® unit as a harness (Fig. A).



Lift the Polyshield® unit a few inches off the pallet and verify that it hangs reasonably level and that the slings are not prone to slipping out of position.



**WARNING**

Keep hands and feet out from under the Polyshield® unit during these steps. If slings slip and the unit tips over, severe personal injury or death may result, as well as irreparable damage to the Polyshield® Combo

If the sling appears to be unstable, set the Polyshield® unit back on the pallet and reposition the slings.

After satisfactory slinging has been achieved, the Polyshield® unit may be hoisted onto its foundation. Take care not to bump the unit against fixed objects or induce any unnecessary shock loads. Lower the unit slowly over the foundation using care to center the unit over the rebar cage. Place shim packs or wedges under the Polyshield® unit at a minimum of eight total or (four [4] locations on each side) to allow for the removal of the slings. Twelve (12) total shim locations or (six [6] shim locations each side are required for Polyshield® units exceeding 6 feet in length.

**Polyshield® with installed equipment:**

**Pump and motor installed:**

Remove the metal shipping straps that hold the Polyshield® unit to the wooden pallet. Slip slings under each end of the Polyshield® unit. This procedure is recommended up to the MTX or LTX pump units. All motors up to a 364T NEMA frame may be installed while mounted. Motor frame sizes 365Tor larger should be removed during locating and installation of the Polyshield® ANSI Combo units. Check to see that the pump suction nozzle does not interfere with the lifting sling. If the pump creates interference, it should be removed. Lift the Polyshield® ANSI Combo a few inches off the pallet and verify that it hangs reasonably level and that the slings are not prone to slipping out of position.

After satisfactory slinging has been achieved, the Polyshield® ANSI Combo may be hoisted onto its foundation. Take care not to bump the unit against fixed objects or induce any unnecessary shock loads. Lower the unit slowly over the foundation using care to center the unit over the rebar cage. Place shim packs or wedges under the Polyshield® unit at a minimum of eight total (or four [4] locations on each side) to allow for the removal of the slings. Twelve (12) total shim locations (or six [6] shim locations each side) are required for Polyshield® units exceeding 6 feet in length.

## Installation

### General Description of the Polyshield® ANSI Combo

The Polyshield® ANSI Combo is a solid, polymer concrete foundation and baseplate shell that is manufactured in versions that conform to accommodate ASME/ANSI B73.1 pumps.

Polyshield® ANSI Combo units are manufactured in five primary sizes with integral catch basins and removable motor mounting blocks.

Metallic thread inserts are provided in the mounting surface for the particular combination of pump and motor that the Combo is intended. The metallic thread inserts on the pump end are available in 316SS (18.8 CrNi stainless steel), Alloy 20 (A744, CN-7M) and Hastelloy C 276 (A494, CW-6M). Multiple motor insert patterns are also available to accommodate more than one NEMA frame size. The standard thread insert material for the motor end is 316SS (18.8 CrNi stainless steel).

Optional alloy pads are available instead of metallic inserts for requirements that call for 0.002"/ft. and or process temperatures between 301° F and 500° F.

### Polyadjust Motor Block Adjuster System

The Polyshield® ANSI Combo utilizes as standard the unique Polyshield® Polyadjust motor mounting system (Fig. B). This system is comprised of a one-piece polymer concrete motor mounting block having surface flatness and parallelism equivalent to machine steel blocks. The Polyadjust motor mounting block system incorporates the Polyloc Transverse Jack Bolt system. The Polyloc system provides transverse motor adjustment. The side-mounted adjusters allow for shaft alignment to critical tolerances with minimal disturbance of indicators. The adjusters make contact with a solid motor mounting block not the foot of the motor.

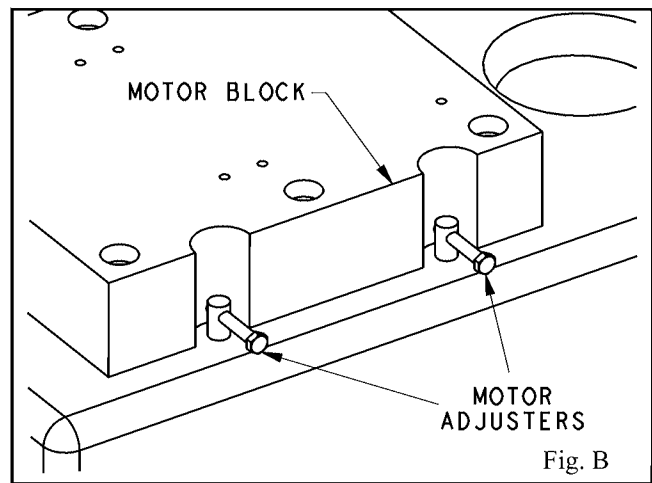


Fig. B

### Polyshield® ANSI and Custom Combos Installation Procedures (NEW CONSTRUCTION)

1. Remove laitance and form grease and oil from area where the Polyshield® ANSI Combo will be located using mechanical means, abrasive blasting, or water blasting. Remove any loose debris including fins, aggregate, or any protruding objects around the perimeter of the area where the Polyshield ANSI Combo will rest.
2. Measure the outside dimensions of the Polyshield® ANSI Combo and subtract 8" from both the width and length to determine the rebar maximum dimension, thus providing clearance from the side of the walls of the ANSI Combo.
3. Drill holes in the existing slab a minimum of four inches deep for doweling in the vertical rebar rods allowing a minimum of one inch clearance from the top of the interior of the Polyshield® ANSI Combo. Space the rebar rods of 12" centers. Remove dust and debris from dowel holes and fill with epoxy adhesive for anchoring the rebar.
4. Allow the epoxy adhesive to cure, and then install horizontal rebar rods, tying in place with wire.
5. Place the Polyshield® ANSI Combo over the rebar cage, making adjustments for proper elevation, orientation relative to piping centerlines. A qualified millwright should field verify proper position of the pump mounting pads relative to the centerline of the suction piping. Appropriate shims may be placed along the bottom edge of the Polyshield® ANSI Combo to aid in leveling. Place shim packs or wedges under the Polyshield® unit at a minimum of eight total (or four [4] locations on each side) to allow for the removal of the slings and metal lifting straps from each end. A minimum of twelve (12) total shim locations (or six [6] shim locations each side) are recommended for Polyshield® units exceeding 7 feet in length.

6. Check and verify the dimensions again before the grouting procedure begins.
7. A low slump standard concrete mix is suitable for filling the Polyshield® ANSI Combo in new construction.
8. Seal around the outside bottom perimeter of the Polyshield® ANSI Combo with a fast setting hydraulic cement. Two brand name hydraulic cements are: **Water Plug Hydraulic Cement** and **Dam-It Non Shrink Hydraulic Cement**
9. Pour the concrete mixture through the grout fill port on the top of the Polyshield® ANSI Combo using a concrete vibrator to ensure proper flow of the concrete. Do not over vibrate as excessive vibrating leads to larger aggregate settling which will result in a weak mix.
10. Pour the concrete to the bottom edge of the grout fill port.
11. Remove any loose debris from around edges of the grout fill port.
12. Seal grout fill port with grout port plug and Polyshield® Seal Kit provided.
13. Install pump, motor, and attach lines.

## TOOLS FOR INSTALLATION

- Hammer drill with proper size bit
- Worm gear saw with diamond blade(if required)
- Rebar cutters (new installation)
- Concrete mixer
- Concrete vibrator
- Lifting device (for placing Polyshield® Foundation)
- Hand tools
- Chipping hammer
- Pressure washer or abrasive blast rig as required
- Epoxy adhesive (for setting rebar into concrete slab – new installation)
- Rebar tie wire
- Fast set cement

## Polyshield® ANSI Combo Sealing Kit Epoxy Novolac (EN) Instructions

### Each Kit contains:

- Polyshield® EN Resin
- Polyshield® EN Hardener
- Stir Sticks
- LATEX Gloves
- Instruction Sheet
- MSDS Material Safety Data Sheet

### Application Instructions:

The Polyshield® EN Sealing Kit is intended for use in (1) bonding the plug into the grout hole at the top of the combo and (2) sealing and providing chemical resistance barrier around the perimeter of pump pad.

1. All surfaces to be bonded should be thoroughly cleaned and should be free of dust, oils and contaminants. Sand surfaces to be bonded prior to use.
2. Pour Polyshield® EN Hardener into the Polyshield® Resin can. Mix well with stir stick for about two minutes.
3. Apply to properly prepared surface by stir stick or putty knife.
4. Use MEK, Xylene solvents for cleaning tools and equipment and for lightly brushing surface to provide a smooth finish.

### Safety Precautions



#### WARNING

*Resin and hardener components may be irritating to the eyes and skin on contact. Vapors may cause irritation of eyes and respiratory tract. Area must be ventilated. Wear protective clothing including gloves. For details safety information, refer to the Material Safety Data Sheets of these products.*

## Polyshield® ANSI Combo Sealing Kit Vinyl Ester (VE) Instructions

### Each Kit contains:

- Polyshield® VE Resin
- Polyshield® VE Hardeners #1
- Stir Sticks
- LATEX Gloves
- Instruction Sheet
- MSDS Material Safety Data Sheet



## Application Instructions

The Polyshield® VE Sealing Kit is intended for use in (1) bonding the plug into the grout hole at the top of the combo and (2) sealing and providing chemical resistance barrier around the perimeter of pump pad.

1. All surfaces to be bonded should be thoroughly cleaned and should be free of dust, oils and contaminants. Sand surfaces to be bonded prior to use.
2. Pour Polyshield® VE Hardener #1 into the Polyshield® VE Resin can. Mix well with stir stick for about two minutes.
3. Apply to properly prepared surface by stir stick or putty knife.
4. Use MEK, Xylene solvents for cleaning tools and equipment and for lightly brushing surface to provide a smooth finish.

## Safety Precautions



### WARNING

*Resin and hardener components may be irritating to the eyes and skin on contact. Vapors may cause irritation of eyes and respiratory tract. Area must be ventilated. Wear protective clothing including gloves. For details on safety information, refer to the Material Safety Data Sheets of these products.*

## Shelf Life and Storage

Store resin and hardener in their unopened containers in a dry cool place away from open flames, heat or sources of ignition. Shelf life is limited to 60 days if stored in a cool, dry location.

Polyshield® Seal Kits provide sealant for every ANSI Combo. Polyshield® Seal Kits are shipped with each ANSI Combo.

## Model 4150 Horizontal Pumps

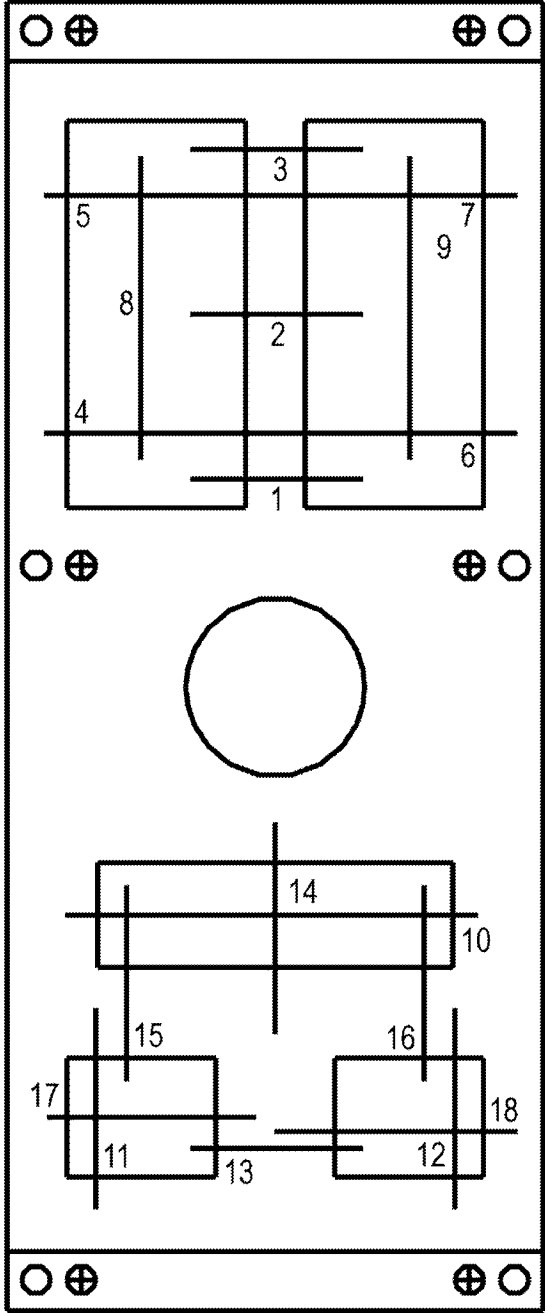
<b>Fastener Standard</b>	<b>Fastener Nominal Size</b>	<b>Recommended Torque<sup>1</sup> lb.-ft.</b>
SAE	$\frac{3}{16}$	6
	$\frac{3}{8}$	10
	$\frac{7}{16}$	18
	$\frac{1}{2}$	27
	$\frac{5}{8}$	53
	$\frac{3}{4}$	94
	$\frac{7}{8}$	152
	1	228

<sup>1</sup> Torque values shown for SAE fasteners are based on dry threads at 75% of proof load for ASTM307 Grades A and B (SAE Grade 1) fasteners.

For lubricated, plated, or PTFE coated threads, use 75% of torque values shown.

*Polyshield®* is a registered trademark, U.S. Patent Nos. 5165651, et. al. apply.

# BASEPLATE LEVELING WORKSHEET



## LEVEL MEASUREMENTS

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_
- 3) \_\_\_\_\_
- 4) \_\_\_\_\_
- 5) \_\_\_\_\_
- 6) \_\_\_\_\_
- 7) \_\_\_\_\_
- 8) \_\_\_\_\_
- 9) \_\_\_\_\_
- 10) \_\_\_\_\_
- 11) \_\_\_\_\_
- 12) \_\_\_\_\_
- 13) \_\_\_\_\_
- 14) \_\_\_\_\_
- 15) \_\_\_\_\_
- 16) \_\_\_\_\_
- 17) \_\_\_\_\_
- 18) \_\_\_\_\_

# ALIGNMENT



## ELECTRICAL



## WARNING

*Before beginning any alignment procedure, make sure driver power is locked out. Failure to lock out driver power will result in serious physical injury.*

To remove guard, refer to coupling guard assembly/disassembly instructions.

The points at which alignment is checked and adjusted are:

- **Initial Alignment** is done prior to operation when the pump and the driver are at ambient temperature.
- **Final Alignment** is done after operation when the pump and driver are at operating temperature.

Alignment is achieved by adding or removing shims from under the feet of the driver and shifting equipment horizontally as needed.

***NOTE: Proper alignment is the responsibility of the installer and user of the unit.***

Accurate alignment of the equipment must be attained. Trouble-free operation can be accomplished by following the procedures in *Appendix II*.

## ALIGNMENT CHECKS

### Initial Alignment (Cold Alignment)

- *Before Grouting Baseplate* - To ensure alignment can be obtained.
- *After Grouting Baseplate* - To ensure no changes have occurred during grouting process.
- *After Connecting Piping* - To ensure pipe strains haven't altered alignment. If changes have occurred, alter piping to remove pipe strains on pump flanges.

### Final Alignment (Hot Alignment)

- *After First Run* - To obtain correct alignment when both pump and driver are at operating temperature. Thereafter, alignment should be checked periodically in accordance with plant operating procedures.

***NOTE: Alignment check must be made if process temperature changes, piping changes and or pump service is performed.***

## ALIGNMENT CRITERIA

Good alignment is achieved when the dial indicator readings as specified in the alignment procedure are:

- .002 in. (.05 mm) Total Indicated Reading (T.I.R.) or less when the pump and driver are at operating temperature (Final Alignment)
- .0005 in. per inch of dial indicator separation for the reverse dial indicator or laser method when the pump and driver are at operating temperature (Final Alignment)

# ALIGNMENT TROUBLESHOOTING

**Table 2**

Problem	Problem Cause	Remedy
Cannot obtain horizontal (Side-to-Side) alignment, angular or parallel	Driver feet bolt bound.	Loosen pump hold down bolts and slide pump and driver until horizontal alignment is achieved.
	Baseplate not leveled properly, probably twisted.	Determine which corner(s) of the baseplate are high or low and remove or add shims at the appropriate corner(s) and realign.

# GROUT BASEPLATE

1. Clean areas of baseplate that will contact grout. Do not use oil-based cleaners because grout will not bond to it. Refer to grout manufacturer's instructions.
2. Build dam around foundation. Thoroughly wet foundation (Fig. 14).

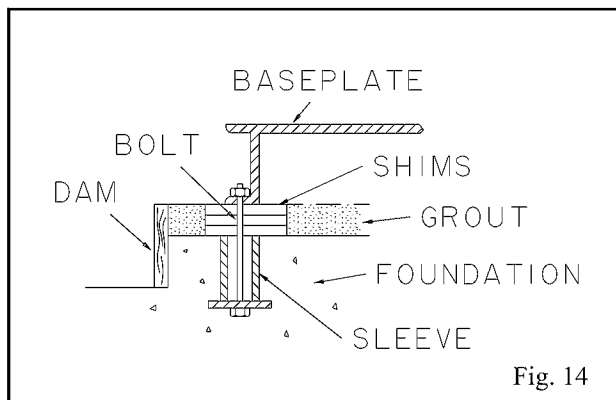


Fig. 14

3. Pour grout through grout hole in baseplate, up to level of dam. Remove air bubbles from grout as it is poured by puddling, using a vibrator, or pumping the grout into place. Non-shrink grout is recommended.
4. Allow grout to set.

5. Fill remainder of baseplate with grout. Remove air as before (Fig. 15).

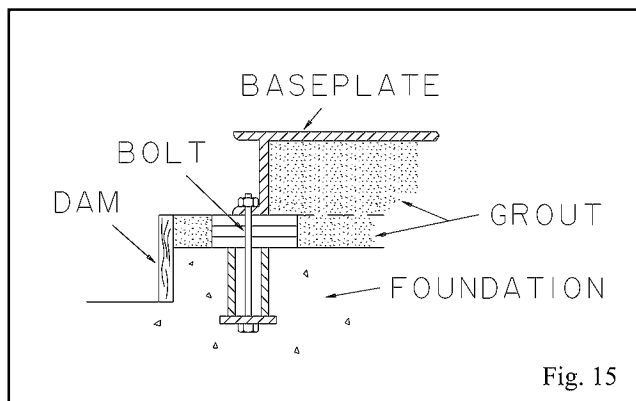


Fig. 15

6. Allow grout to set at least 48 hours.
7. Tighten foundation bolts.

## ALIGNMENT CHECK

Re-check alignment before continuing, using methods previously described.

# PIPING

## GENERAL

Guidelines for piping are given in the "Hydraulic Institute Standards" available from: Hydraulic Institute, 9 Sylvan Way, Parsippany, NJ 07054-3802 and must be reviewed prior to pump installation.



### WARNING

*Never draw piping into place by forcing at the flanged connections of the pump. This may impose dangerous strains on the unit and cause misalignment between pump and driver. Pipe strain will adversely effect the operation of the pump resulting in physical injury and damage to the equipment.*

## PIPING THE PUMP

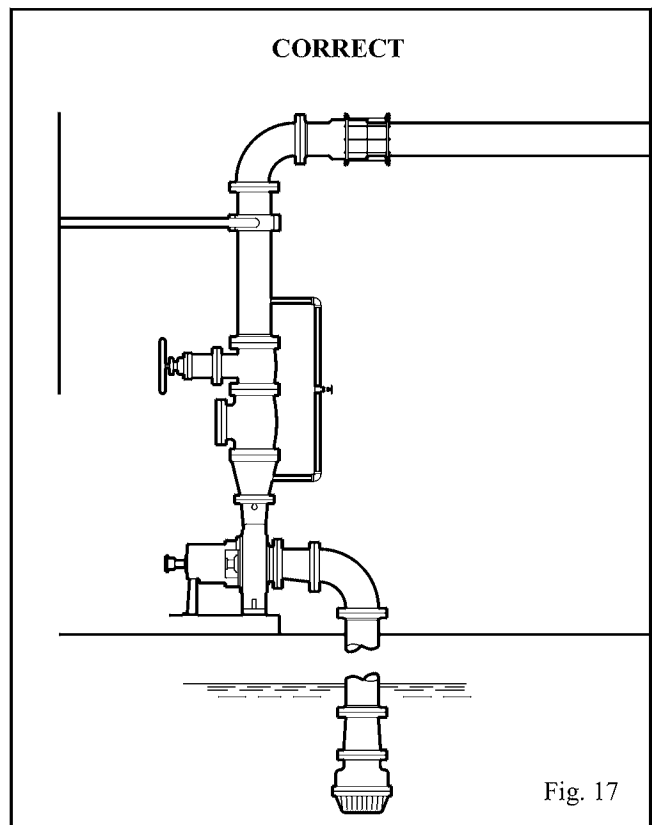
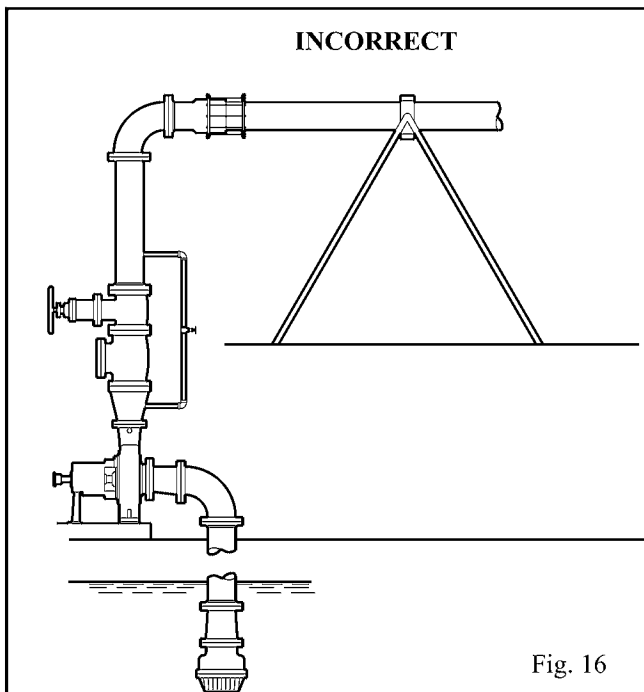
Piping must not be connected to the pump until base, pump, and driver are initially aligned. Failure to do so may result in the inability to attain proper alignment later. All flanged connections to the pump should be full flat face with full contact gaskets. Raised face flanges or partial contact gaskets should not be used as excessive strains can be applied to the pump flanges upon tightening. The pump has

been designed with all necessary strength factors for long, reliable service life. However, due to the composite construction, care must be taken during installation to avoid unnecessary pipe strain. If severe piping strains are to be encountered, flexible connections are recommended in the suction and discharge pipe lines. When lined piping is used, flange alignment should be carefully checked. Spacer ring gaskets are recommended to assure parallel alignment of pipe and pump flanges. The following flange bolt torque values should be used:

<b>Table 3</b>	
<b>Flange Size (Inches)</b>	<b>Bolt Torque (Ft-Lbs)</b>
1 1/2"	9-12
2"	18-24
3"	23-30
4"	27-36
6" & Larger	35-50

All piping must be supported independently of the pump. The piping should always line up naturally with the pump flanges. Never draw the piping to the suction or discharge flanges of the pump. Outside installations should be properly compensated for changes in ambient temperatures. Refer to pipe manufacturers standards for proper installation. Omission of this could result in severe strain transmitted to the pump flanges. The piping should be as short and direct as possible. Avoid all unnecessary elbows, bends and fittings, as they increase friction losses in the piping.

1. All piping must be supported independently of, and line up naturally with, the pump flanges.
2. Piping runs should be as short as possible to minimize friction losses.
3. **DO NOT** connect piping to pump until grout has hardened and pump and driver hold-down bolts have been tightened.
4. It is suggested that expansion loops or joints, if used, be properly installed in suction and/or discharge lines when handling liquids at elevated temperatures, so linear expansion of piping will not draw pump out of alignment (Fig. 16 & 17).



5. The piping should be arranged to allow pump flushing prior to removal of the unit on services handling corrosive liquids.
6. Carefully clean all pipe parts, valves and fittings, and pump branches prior to assembly.

## SUCTION PIPING



### WARNING

*NPSH<sub>A</sub> must always exceed NPSH<sub>R</sub> as shown on Goulds performance curves received with order. Reference Hydraulic Institute for NPSH and pipe friction values needed to evaluate suction piping.*

Properly installed suction piping is a necessity for trouble-free pump operation. Suction piping should be flushed **BEFORE** connection to the pump.

1. Use of elbows close to the pump suction flange should be avoided. There should be a minimum of two pipe diameters of straight pipe between the elbow and suction inlet. Where used, elbows should be long radius (Fig. 18).

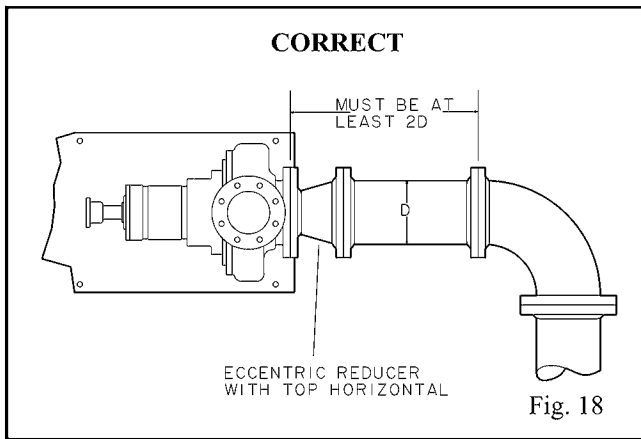


Fig. 18

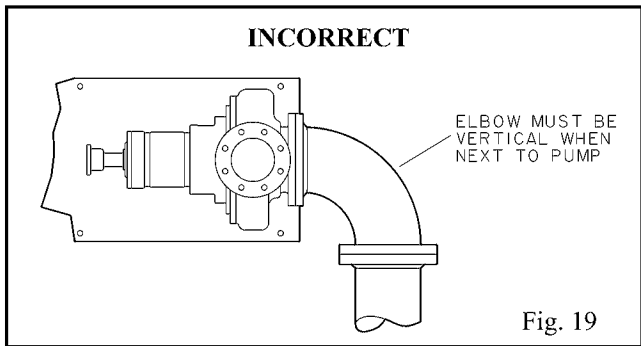


Fig. 19

2. Use suction pipe one or two sizes larger than the pump suction, with a reducer at the suction flange. **Suction piping should never be of smaller diameter than the pump suction.**
3. Reducers should be eccentric at the pump suction flange with sloping side down and horizontal side at the top (Figs. 20, 21, 22).

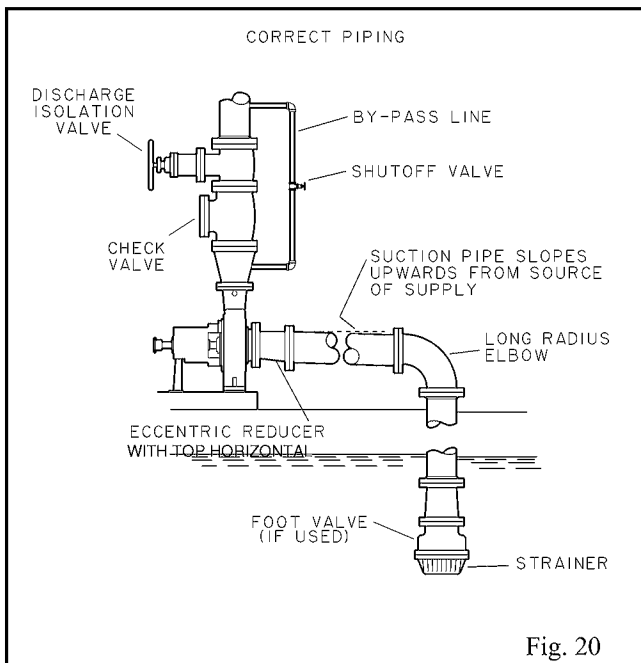


Fig. 20



## CAUTION

*Pump must never be throttled on suction side.*

4. Suction strainers, when used, must have a net “free area” of at least three times the suction pipe area.
5. Separate suction lines are recommended when more than one pump is operating from the same source of supply.

### Suction Lift Conditions

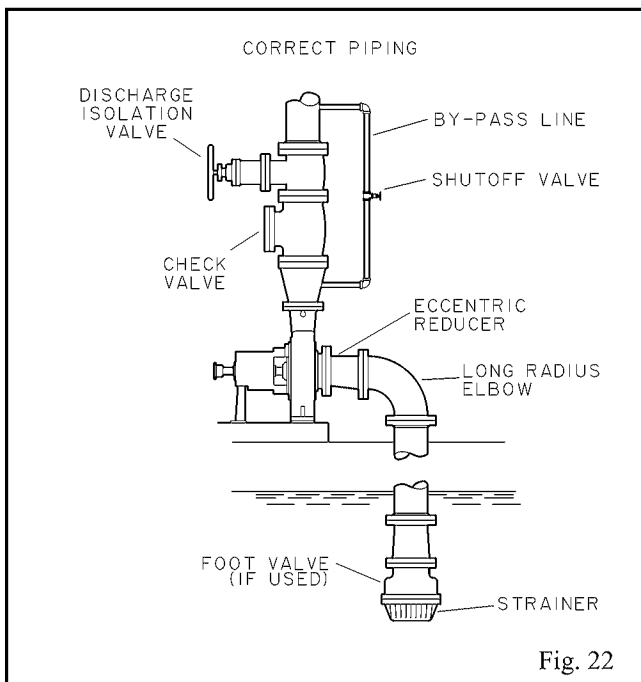
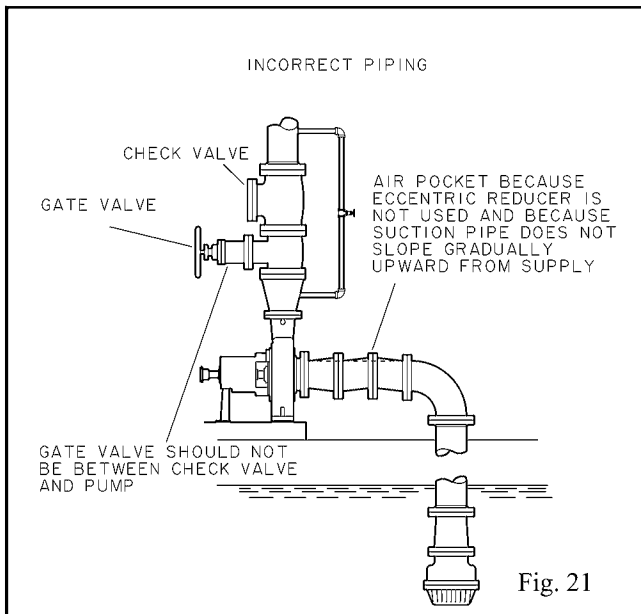
1. Suction pipe must be free from air pockets.
2. Suction piping must slope upwards to pump.
3. All joints must be air tight.
4. A means of priming the pump must be provided, such as a foot valve, except for the 3796 self priming pump.

### Suction Head / Flooded Suction Conditions

1. An isolation valve should be installed in the suction line at least two pipe diameters from the suction to permit closing of the line for pump inspection and maintenance.
2. Keep suction pipe free from air pockets.
3. Piping should be level or slope gradually downward from the source of supply.
4. No portion of the piping should extend below pump suction flange.
5. The size of entrance from supply should be one or two sizes larger than the suction pipe.
6. The suction pipe must be adequately submerged below the liquid surface to prevent vortices and air entrainment at the supply.

## DISCHARGE PIPING

1. Isolation and check valves should be installed in discharge line. Locate the check valve between isolation valve and pump, this will permit inspection of the check valve. The isolation valve is required for priming, regulation of flow, and for inspection and maintenance of pump. The check valve prevents pump or seal damage due to reverse flow through the pump when the driver is turned off.
2. Increases, if used, should be placed between pump and check valves.
3. Cushioning devices should be used to protect the pump from surges and water hammer if quick-closing valves are installed in system.



## ANCILLARY PIPING

The diameter of the ancillary or seal piping should be large enough to meet the seal flushing requirements. Typically this is 1/4-1/2 GPM at a pressure of 15-25 PSI above the suction pressure for most mechanical seals. Refer to *Appendix III* for recommended seal flush flow rates and piping installations.

Where the ancillary piping is connected to the pump only plastic fittings shall be used.

**! WARNING**

*Failure to use plastic fittings may result in damage to the pump.*

Many flush systems incorporate electrically actuated solenoid valves to conserve and control the flow of flush liquids. Ensure that the flush liquid is flowing to the seal before the pump is started.

3

On double seal arrangements with flush in and flush out connections, flow control valves should be installed in the flush out or downstream side. The pump shaft should turn freely by hand after the piping has been connected to the pump. This is to insure that the piping has not caused binding in the pump. If binding occurs, check alignment and realign if necessary.

## FINAL PIPING CHECK

### After connecting the piping to pump:

1. Rotate shaft several times by hand to be sure that there is no binding and all parts are free.
2. Check alignment, per the alignment procedure outlined previously to determine absence of pipe strain. If pipe strain exists, correct piping.





# OPERATION

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## PREPARATION FOR START-UP

### CHECKING ROTATION

**CAUTION**

*Serious damage may result if pump is run in the wrong rotation.*

1. Lock out power to driver.

**ELECTRICAL**

**WARNING**

*Lock out driver power to prevent accidental start-up and physical injury.*

2. Make sure coupling hubs are securely fastened to the shafts and the coupling spacer has been removed.

**NOTE:** *Pump is shipped with coupling spacer removed.*

3. Unlock driver power.
4. Make sure everyone is clear. Jog driver just long enough to determine direction of rotation. Rotation must correspond to arrow on bearing housing.
5. Lock out power to driver.

### CHECK IMPELLER CLEARANCE

Prior to operating the pump, impeller clearances must be checked. This check will help ensure that the pump turns freely and that it operates at optimal efficiency for good equipment life and low energy consumption. See *Table 4* for details.

The maximum impeller setting should not be set more than .005 inch (0.13mm) above values in *Table 4* or significant performance degradation will result.

See *Preventive Maintenance* section for impeller adjustment procedure.

<b>Table 4</b>		
<b>Impeller Clearances</b>		
<b>Impeller diameter (inches)</b>	<b>Clearance (inches)</b>	<b>Clearance (mm)</b>
up to 8	0.015	0.381
8.125 to 10	0.020	0.508
10.125 to 16	0.025	0.635

## COUPLE PUMP AND DRIVER



### ELECTRICAL



### WARNING

*Lock out driver power to prevent accidental rotation and physical injury.*

1. Install and lubricate coupling per manufacturer's instructions.
2. Install coupling guard (Fig. 23). Refer to *Coupling Guard Installation and Disassembly* section Appendix I.



### WARNING

*Never operate a pump without coupling guard properly installed. Refer to Appendix I for coupling guard installation instructions. Personal injury will occur if pump is run without coupling guard.*

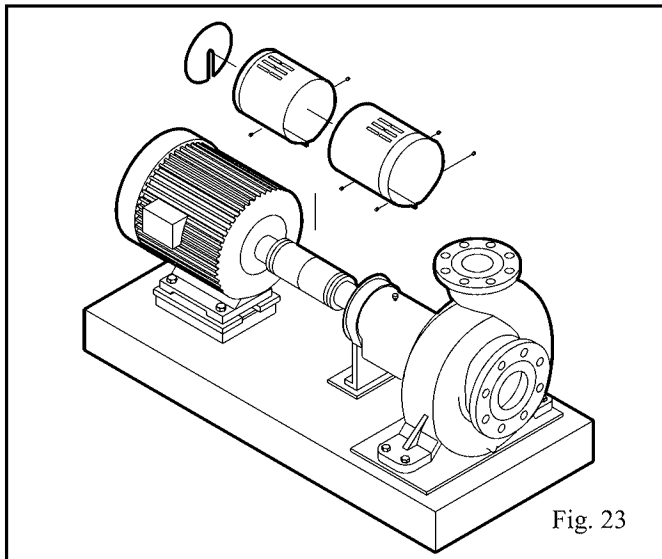


Fig. 23

## LUBRICATING BEARINGS



### CAUTION

*Pumps are shipped without oil.*

**Oil Lubrication:** Fill bearing frame with oil, through filler connection, until oil level reaches the middle of the sight-glass. A high quality turbine type oil with rust and oxidation inhibitors should be used. See *Table 6* in the *Preventive Maintenance* section for recommendations.

**Grease Lubrication:** Pumps are shipped **with** grease. See *Table 7* in the *Preventive Maintenance* section for grease requirements.

**Greased For Life Bearings:** These bearings are filled with grease and sealed by the bearing manufacturer.

If the pump is put into operation after a prolonged shut down, flush out the bearings and bearing frame with a light oil to remove contaminants. During flushing, rotate the shaft slowly by hand. Finally, flush the bearing housing with proper lubricating oil to insure oil quality after cleaning.

See *Preventive Maintenance* section for lubrication recommendations.



### CAUTION

*Operation of the unit without proper lubrication will cause bearing failure and pump seizure.*

## SEAL FLUSHING

### Mechanical Seal

Do not operate the pump without liquid to the mechanical seal. Depending on the flush arrangement of the pump, the fluid to the seal may be piped from the pump discharge externally or internally, or from an external clean source. If the pump is fitted with an internal or bypass flush arrangement, then the pump must be flooded with liquid prior to starting to ensure that the mechanical seal is lubricated. If the pump is equipped for an external flush system, then flush liquid must be supplied to the seal prior to starting. Proper flow for external flushing will vary from 1/4 to 1/2 GPM at a pressure of 15 to 25 PSI above the stuffing box pressure.

### Packed Stuffing Box

This method of sealing the pump requires an external flush line for the intake of flush liquid. The flush line must supply liquid to the packing prior to operation. The packing gland must be adjusted at start-up of the pump for proper operation. When the pump is put into operation, the gland should be considerably loose. After the pump is operating, the gland should be slowly tightened to reduce the amount of leakage. Each time the packing is tightened the amount of flush liquid will decrease, however as the packing warms up it will swell slowing the flow of flush liquid even more. A slight flow of liquid from the stuffing box is necessary to provide lubrication and cooling (approximately 40 - 60 drops per minute after the packing has run in).



### CAUTION

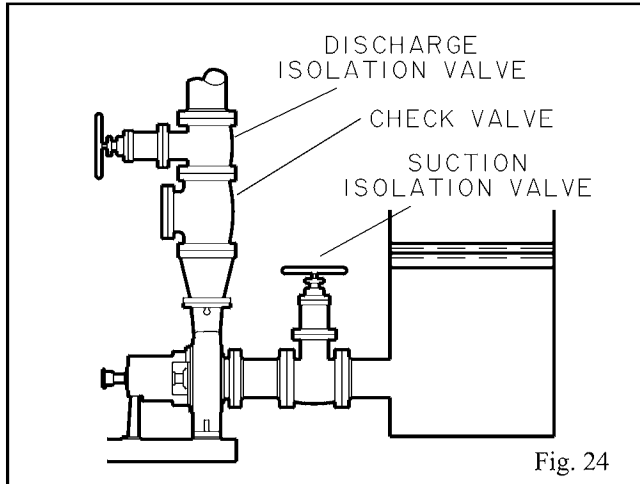
*Packing containing fluorocarbon compounds must be constantly checked when first started as it has a tendency to rapidly expand from temperature changes resulting in blockage of the flush liquid. Failure to do so may result in damage to the pump.*

## PRIMING PUMP

Never start the pump until it has been properly primed. Several different methods of priming can be used, depending upon type of installation and service involved.

### Suction Supply Above Pump

1. Slowly open the suction valve (Fig. 24).



2. Open air vents on the suction and discharge piping until water flows out.
3. Close the vent valves.

### Suction Supply Below Pump

A foot valve and outside source of liquid may be used to prime the pump. Outside source of liquid can come from a priming pump, pressurized discharge line, or other outside supply (Fig. 25 and 26).

1. Close discharge valve and open air vents in casing.
2. Open valve in outside supply line until only liquid escapes from vent valves.
3. Close the vent valves and then the outside supply line.

### Other Methods of Priming:

1. Priming by Ejector.
2. Priming by Automatic Priming Pump.

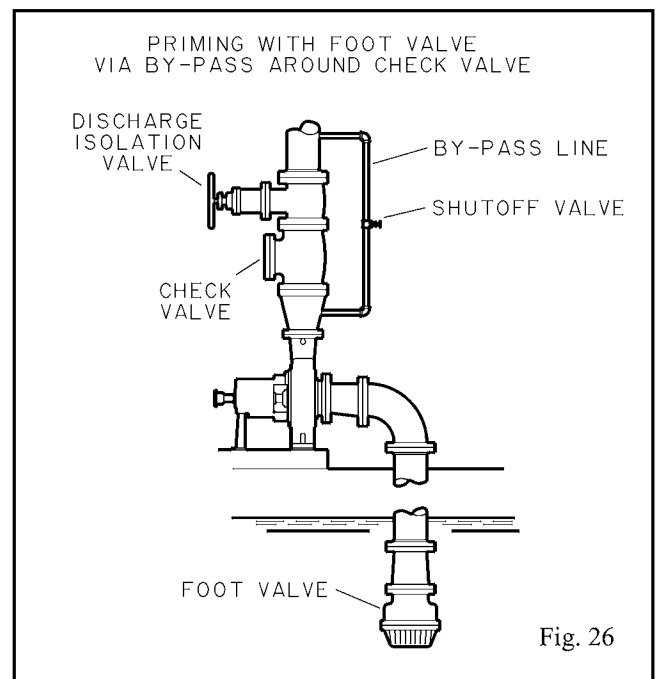
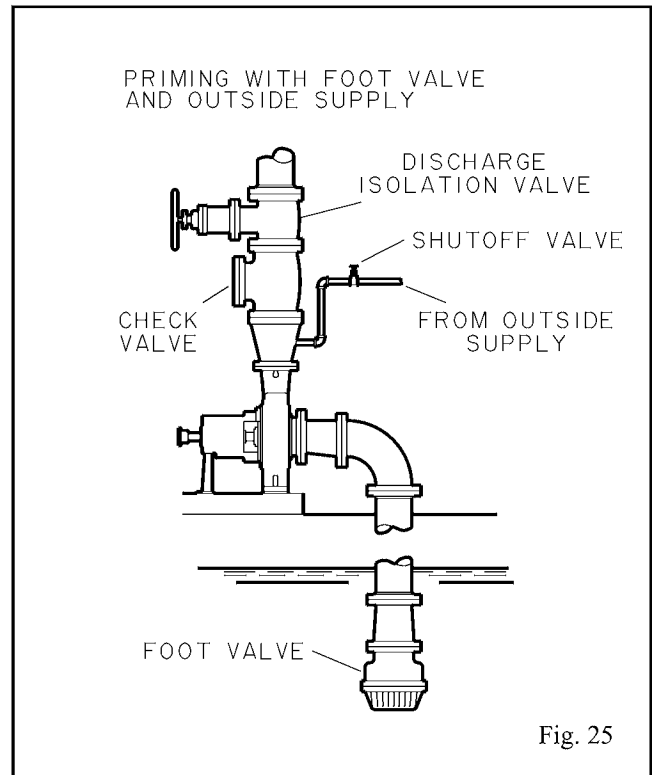


## CAUTION

### START-UP PRECAUTIONS

1. All equipment and personal safety related devices and controls must be installed and operating properly.
2. To prevent premature pump failure at initial start-up due to dirt or debris in the pipe system, ensure the system has been adequately cleaned and flushed.
3. Variable speed drivers should be brought to rated speed as quickly as possible.

4. Variable speed drivers should not be adjusted or checked for speed governor or overspeed trip settings while coupled to the pump at initial start-up. If settings have not been verified, uncouple the unit and refer to driver manufacturer's instructions for assistance.



5. Running a new or rebuilt pump at slow speeds may not provide enough flow to adequately flush and cool the stuffing box bushing's close running surfaces.

- Pumpage temperatures in excess of 200° F (93° C) will require warm-up of pump prior to operation. Circulate a small amount of pumpage through the pump until the

casing temperature is within 100° F (38° C) of the pumpage temperature and evenly heated.

**NOTE:** Warm-up rate should not exceed 1.4° C (2.5° F) per minute.

## STARTING PUMP

- Make sure suction valve and any recirculation or cooling lines are open.
- Fully close or partially open discharge valve as dictated by system conditions.
- Start driver.
- Slowly open discharge valve until the desired flow is obtained.



### CAUTION

*Immediately observe pressure gauges. If discharge pressure is not quickly attained - stop driver, reprime and attempt to restart.*



### CAUTION

*Observe pump for vibration levels, bearing temperature and excessive noise. If normal levels are exceeded, shut down and resolve.*

## OPERATION

### GENERAL CONSIDERATIONS



### CAUTION

*Always vary capacity with regulating valve in the discharge line. NEVER throttle flow from the suction side.*



### CAUTION

*Driver may overload if the pumpage specific gravity (density) is greater than originally assumed, or the rated flow rate is exceeded.*



### CAUTION

*Always operate the pump at or near the rated conditions to prevent damage resulting from cavitation or recirculation.*

### OPERATING AT REDUCED CAPACITY



### WARNING

*DO NOT operate pump below minimum rated flows or with suction and/or discharge valve closed. These conditions may create an explosive hazard due to vaporization of pumpage and can quickly lead to pump failure and physical injury.*



### CAUTION

*Damage occurs from:*

- Increased vibration levels - Affects bearings, stuffing box or seal chamber, and mechanical seal.
- Increased radial loads - Stresses on shaft and bearings.
- Heat build up - Vaporization causing rotating parts to score or seize.
- Cavitation - Damage to internal surfaces of pump.

### OPERATING UNDER FREEZING CONDITIONS

Exposure to freezing conditions, while pump is idle, could cause liquid to freeze and damage the pump. Liquid inside pump should be drained. Liquid inside cooling coils, if supplied, should also be drained.

# SHUTDOWN

1. Slowly close discharge valve.
2. Shut down and lock driver to prevent accidental rotation.



## WARNING

*When handling hazardous and/or toxic fluids, proper personal protective equipment should be worn. If pump is being drained, precautions must be taken to prevent physical injury. Pumpage must be handled and disposed of in conformance with applicable environmental regulations.*



# PREVENTIVE MAINTENANCE

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## GENERAL COMMENTS

A routine maintenance program can extend the life of your pump. Well maintained equipment will last longer and require fewer repairs. You should keep maintenance records, this will help pinpoint potential causes of problems.

## MAINTENANCE SCHEDULE

### ROUTINE MAINTENANCE

- Bearing lubrication
- Seal monitoring
- Vibration analysis
- Discharge pressure
- Temperature monitoring

### ROUTINE INSPECTIONS

- Check level and condition of oil through sight glass on bearing frame.
- Check for unusual noise, vibration and bearing temperatures.
- Inspect pump and piping for leaks.
- Check seal chamber/stuffing box leakage.
- Mechanical Seal: Should be no leakage.
- Packing: Excessive leakage requires adjustment or possible packing replacement. Refer to *Operation* section for packing gland adjustment.

### 3 MONTH INSPECTIONS

- Check the foundation and the hold-down bolts for tightness.
- If the pump has been left idle, check the packing. Replace if required.
- Oil should be changed at least every 3 months (2000 hours) or more often if there are any adverse atmospheric conditions or other conditions which might contaminate or break down the oil. If it is cloudy or contaminated as seen by inspection through the sight glass, it should be changed immediately.
- Check the shaft alignment. Realign if required.

### ANNUAL INSPECTIONS

- Check the pump capacity, pressure and power. If pump performance does not satisfy your process requirements, and the process requirements have not changed, the pump should be disassembled, inspected, and worn parts should be replaced. Otherwise, a system inspection should be done.

### INSPECTION INTERVALS

Inspection intervals should be shortened appropriately if the pumpage is abrasive and/or corrosive,

# MAINTENANCE OF BEARINGS

## OIL LUBRICATED BEARINGS



### WARNING

*Pumps are shipped without oil. Oil lubricated bearings must be lubricated at the job site.*

Remove fill plug and add oil until level is at the center of the sight glass (319). Replace fill plug, *Table 5*.

Change the oil after 200 hours for new bearings, thereafter every 2000 operating hours or 3 months (whichever comes first).

<b>Table 5 Oil Volumes</b>		
<b>Frame Size</b>	<b>Oz.</b>	<b>ml</b>
Group 1	12	355
Group 2	40	1185
Group 3	96	2840

A high quality turbine oil with rust and oxidation inhibitors should be used. For the majority of operational conditions, bearing temperatures will run between 120°F (50°C) and 180°F (82°C). In this range, an oil of ISO viscosity grade 68 at 100°F (40°C) is recommended.

<b>Table 6 Lubricating Oil Requirements</b>		
	<b>Pumpage temperature below 350°F (177°C)</b>	<b>Pumpage temperature above 350°F (177°C)</b>
<b>ISO Grade</b>	<b>VG 68</b>	<b>VG 100</b>
Approx. SSU at 100°F (38°C)	300	470
DIN 51517	C68	C100
Kinem. viscosity at 100°F (40°C) mm/sec	68	100

### Some acceptable lubricants are:

Chevron	GTS Oil 68
Exxon	Teresstic 68 or NUTO H68
Mobil	Mobil DTE 26 300 SSU @ 100°F (38°C)
Philips	Mangus Oil 315
Shell	Tellus Oil 68
Sunoco	Sunvis 968
Royal Purple	SYNFILM ISO VG 68 Synthetic Lube

## GREASE LUBRICATED BEARINGS

**Grease lubricated bearings are pre-lubricated at the factory.** Most pumps have Sunoco 2EP grease. High temperature units (pumpage temperature greater than 350° F) use Mobil SCH32. Regrease bearings every 2000 operating hours or 3 months.

### Regrease Procedure:

***NOTE: When regreasing, there is danger of impurities entering the bearing housing. The grease container, the greasing device, and fittings must be clean.***

1. Wipe dirt from grease fittings.
2. Remove 2 grease relief plugs from bottom of frame.
3. Fill both grease cavities through fittings with recommended grease until fresh grease comes out of the relief holes. Reinstall grease relief plugs.
4. Ensure frame seals are seated in bearing housing and, if not, press in place with drains located at the bottom.

***NOTE: The bearing temperature usually rises after regreasing due to an excess supply of grease. Temperatures will return to normal after pump has run and purged the excess from the bearings, usually two to four hours.***



For most operating conditions a lithium based mineral oil grease of NLGI consistency No. 2 is recommended. This grease is acceptable for bearing temperatures of 5°F to 230°F (-15°C to 110°C). Bearing temperatures are generally about 20°F (18°C) higher than bearing housing outer surface temperature.

**Table 7  
Lubricating Grease  
Requirements**

	Pumpage temperature below 350°F (177°C)	Pumpage temperature above 350°F (177°C)
NLGI consistency	2	3
Mobil	Mobilux EP2	SCH32
Exxon	Unirex N2	Unirex N3
Sunoco	Multipurpose 2EP	
SKF	LGMT 2	LGMT 3



### CAUTION

*Never mix greases of different consistency (NLGI 1 or 3 with NLGI 2) or different thickener. For example never mix a lithium base grease with a polyurea base grease.*

Pumpage temperatures above 350°F (177°C) should be lubricated by a high temperature grease. Mineral oil greases should have oxidation stabilizers and a consistency of NLGI 3.

*NOTE: If it is necessary to change grease type or consistency, the bearings must be removed and the old grease removed.*

## MAINTENANCE OF SHAFT SEALS

### MECHANICAL SEALS

When mechanical seals are furnished, a manufacturer's reference drawing is supplied with the data package. This drawing should be kept for future use when performing maintenance and adjusting the seal. The seal drawing will also specify required flush liquid and attachment points. The seal and all flush piping must be checked and installed as needed prior to starting the pump.

The life of a mechanical seal depends on various factors such as cleanliness of the liquid handled and its lubricating properties. Due to the diversity of operating conditions it is, however, not possible to give definite indications as to its life.



### WARNING

*Never operate the pump without liquid supplied to mechanical seal. Running a mechanical seal dry, even for a few seconds, can cause seal damage and must be avoided. Physical injury can occur if mechanical seal fails.*

### PACKED STUFFING BOX

Packing operation can be inspected without shutting down or disassembling the pump. During normal operation the packing should leak approximately one drop per minute. If the drip rate is higher or lower than one drop per minute then an adjustment of the gland may be required. To slow down the leakage rate, the two gland bolts should be tightened evenly one-quarter (1/4) turn each until the desired leakage rate is obtained. NEVER over-tighten packing to the point where less than one drop per minute is observed. Overtightening can cause excessive wear and power consumption during operation. If the packing cannot be tightened to obtain less than two drops per minute, then the packing may need to be replaced and the packing installation procedures under Operation should be followed.



### CAUTION

*Never attempt to replace packing until the driver is properly locked out and the coupling spacer is removed.*

# IMPELLER CLEARANCE SETTING



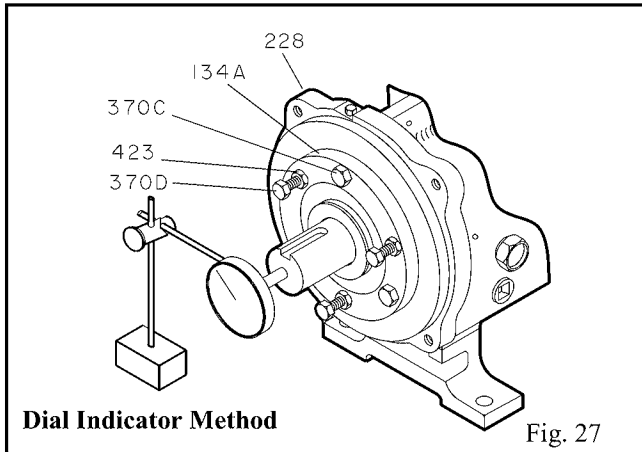
## WARNING

*Lock out driver power to prevent accidental startup and physical injury.*

A change in pump performance may be noted over time by a drop in head or flow or an increase in power required. Performance can usually be renewed by adjusting the impeller clearance. Two techniques are given to set the impeller clearance, the dial indicator method and the feeler gauge method.

### DIAL INDICATOR METHOD

1. Remove coupling guard. Refer to coupling guard instructions *Appendix I*.
2. Remove coupling.
3. Set indicator so that button contacts either the shaft end or against face of coupling (Fig. 27).
4. Loosen jam nuts (423) on jack bolts (370D) and back bolts out about two turns.
5. Tighten each locking bolt (370C) evenly, drawing the bearing housing (134A) towards the bearing frame (228) until impeller contacts the casing. Turn the shaft to ensure contact is made.

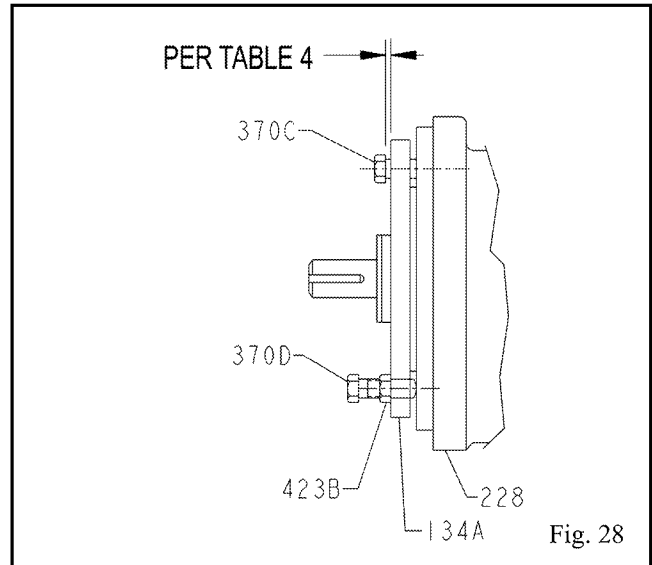


6. Set indicator to zero and back locking bolt (370C) out about one turn.
7. Thread jack bolts (370D) in until they evenly contact the bearing frame. Tighten the jack bolts evenly (about one flat at a time) backing the bearing housing (134A) away from the bearing frame until the indicator shows the proper clearance per *Table 4*.
8. Evenly tighten locking bolts (370C), then jack bolts (370D) keeping indicator reading at proper setting.
9. Check shaft for free turning.

10. Replace coupling guard.

### FEELER GAUGE METHOD

1. Remove coupling guard. Refer to coupling guard instructions in *Appendix I*.
2. Loosen jam nuts (423) on jack bolts (371A) and back bolts out about two turns (Fig. 27).
3. Tighten locking bolts (370C) evenly, drawing bearing housing (134A) towards frame (228) until impeller contacts the casing. Turn shaft to ensure contact is made.
4. Using a feeler gauge, set the gap between the three locking bolts (370C) and bearing housing (134A) per impeller clearances in *Table 4*.
5. Evenly back out bearing housing (134A) using the three jack bolts (370D) until it contacts the locking bolts (370C). Evenly tighten jam nuts (423B).
6. Check shaft for free turning.
7. Replace coupling guard.



**Table 4**  
**Impeller Clearances**

Impeller diameter (inches)	Clearance (inches)	Clearance (mm)
up to 8	0.015	0.381
8.125 to 10	0.020	0.508
10.125 to 16	0.025	0.635

# TROUBLESHOOTING

Problem	Probable Cause	Remedy
<b>No liquid delivered.</b>	Pump not primed.	Reprime pump, check that pump and suction line are full of liquid.
	Suction line clogged.	Remove obstructions.
	Impeller clogged with foreign material.	Back flush pump to clean impeller.
	Wrong direction of rotation.	Change rotation to concur with direction indicated by arrow on bearing housing or pump casing.
	Foot valve or suction pipe opening not submerged enough.	Consult factory for proper depth. Use baffle to eliminate vortices.
	Suction lift too high.	Shorten suction pipe.
<b>Pump not producing rated flow or head</b>	Air leak thru gasket.	Replace gasket.
	Air leak thru stuffing box.	Replace or readjust packing/mechanical seal.
	Impeller partly clogged.	Back flush pump to clean impeller.
	Excessive impeller-to-casing clearance.	Adjust impeller clearance.
	Insufficient suction head.	Ensure that suction line shutoff valve is fully open and line is unobstructed.
	Worn or broken impeller.	Inspect and replace if necessary.
<b>Pump starts then stops pumping</b>	Improperly primed pump.	Reprime pump.
	Air or vapor pockets in suction line.	Rearrange piping to eliminate air pockets.
	Air leak in suction line.	Repair (plug) leak.
<b>Bearings run hot</b>	Improper alignment.	Realign pump and driver.
	Improper lubrication.	Check lubricant for suitability and level.
	Lube cooling.	Check cooling system.
<b>Pump is noisy or vibrates</b>	Improper pump/driver alignment.	Align shafts.
	Partly clogged impeller causing imbalance.	Back-flush pump to clean impeller.
	Broken or bent impeller or shaft.	Replace as required.
	Foundation not rigid.	Tighten hold down bolts of pump and motor or adjust stilts.
	Worn bearings.	Replace.
	Suction or discharge piping not anchored or properly supported.	Anchor per Hydraulic Institute Standards Manual recommendations.
	Pump is cavitating.	Locate and correct system problem.
<b>Excessive leakage from stuffing box</b>	Packing gland improperly adjusted.	Tighten gland nuts.
	Stuffing box improperly packed.	Check packing and repack box.
	Worn mechanical seal parts.	Replace worn parts.
	Overheating mechanical seal.	Check lubrication and cooling lines.
	Shaft sleeve scored.	Remachine or replace as required.
<b>Motor requires excessive power</b>	Head lower than rating. Pumps too much liquid.	Consult factory. Install throttle valve, trim impeller diameter.
	Liquid heavier than expected.	Check specific gravity and viscosity.
	Stuffing box packing too tight.	Readjust packing. Replace if worn.
	Rotating parts bind.	Check internal wearing parts for proper clearances.



# DISASSEMBLY & REASSEMBLY

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## GENERAL COMMENTS

The 4150 pump is designed for easy inspection and service because of its back pullout construction. For inspection or replacement of certain parts, the work can be done in place, without the necessity to remove the complete pump to a maintenance area. Refer to applicable Sectional Drawing in this manual for item numbers mentioned below. Before any work is done the following procedures and precautions should be taken:

**ELECTRICAL**

**WARNING**  
*The electric motor should be either disconnected from its power source, or the switch or circuit breaker must be secured in an "off" position so that the motor cannot be accidentally started.*

1. Check the valves on the suction and discharge lines to be sure they are closed and secured.

2. If the mechanical seal is flushed from an external source, turn off the valve in the supply line and disconnect the flush line.

**WARNING**  
*The pump may handle hazardous and/or toxic fluids. Proper personal protective equipment should be worn. Precautions must be taken to prevent physical injury. Pumpage must be handled and disposed of in conformance with applicable environmental regulations.*

*NOTE: Before disassembling the pump for overhaul, ensure all replacement parts are available.*

3. The liquid trapped in the pump and piping should be drained. Care should be taken to either trap the fluid in a container or to divert it to a proper disposal area so that the area around the pump and base will not be contaminated.

## DISASSEMBLY

1. Remove the bolts securing the coupling guard and remove the coupling guard.
2. Refer to the coupling manufacturer's data that was included with the pump.
3. If the complete pump is to be removed to a maintenance area, remove the bolts holding the power-frame and casing to the baseplate. Next

remove the bolts on the suction and discharge flange connections. Now the whole pump can be removed. If the casing is to be left in place remove the screws holding the power-frame to the baseplate and then remove the casing bolts, nuts and washers securing the casing to the cover and frame adapter. Now the rotating assembly can be pulled away from the casing and removed. Two jackscrews are provided to ease disassembly.



4. If the casing was removed with the pump, remove the through bolts, nuts and washers securing the casing to the cover and frame adapter. Now the casing can be pulled away from the power-frame and cover. Two jackscrews are provided to ease disassembly. The pump rotating assembly can be placed in a convenient location to disassemble.
5. Remove the cover o-ring (412V) and place into a container with the casing hardware.
6. If the pump is provided with a mechanical seal utilizing set screws to drive the seal, loosen the set screws. If the mechanical seal is of the preset outside type, re-install seal setting clips, before loosening set screws.
7. The impeller assembly can now be removed by fixing the pump shaft at the coupling end and turning the impeller in a counter-clock wise direction facing the impeller. A strap wrench or similar device may be required to disengage the screw threads. The impeller, cover, and seal assembly can now be removed as a unit by unthreading the assembly off the pump shaft. If the pump is provided with a separate shaft sleeve, remove the impeller and impeller o-ring. Proceed to remove the cover, separate sleeve and seal assembly.
- 8A. If the mechanical seal is a single outside seal, be sure the set screws are loose and pull the rotary seal assembly off the sleeve using a twisting motion as it is removed. The integral sleeved impeller can now be removed from the cover. Remove the four bolts and washers securing the gland to the cover and remove the gland and then the seal stationary member from the cover. The carbon and ceramic elements of the seal should be handled carefully to prevent chipping or scratching.
- 8B. If the mechanical seal is a double inside seal, remove the four bolts and washers securing the gland to the cover and remove the gland. Be sure the set screws are loose and pull the rotary seal assembly off the sleeve using a twisting motion as it is removed. The integral sleeved impeller can be removed from the cover. Next remove the stationary seal faces from the gland and cover by gently pressing them out using your thumbs. The carbon and ceramic elements of the seal should be handled carefully to prevent chipping or scratching.
- 8C. If packing is supplied with the pump then first remove the upper four nuts and washers securing the gland and remove the gland. Next remove the lower four nuts and washers and remove the stuffing box extension. Now remove the packing rings and lantern ring, keeping them in order to preserve the location of the lantern ring. The gland studs can now be removed from the cover.

## POWER-FRAME DISASSEMBLY

After removing the pump casing, impeller, and cover assembly from the power-frame, proceed with the following:

1. Drain oil from the power-frame assembly by removing the drain plug. Collect oil into a suitable container.
2. Remove the deflector, if the pump utilizes oil seals, by sliding off the shaft.
3. Remove only the adjusting screws that secure the bearing housing to the power-frame.
4. The shaft assembly is now ready for removal. Slowly and evenly turn the remaining adjusting jacking screws until the outboard bearing housing clears the frame. This will require the use of shims or bar-stock being placed between the adjusting jacking screws and bearing frame. The adjusting jacking screws by themselves are not long enough to effect complete clearance from the frame. Be careful when removing the shaft assembly not to damage the impeller threads on the end of the shaft by contacting the cast-iron. You now should be holding the shaft, bearings, and outboard bearing housing assembly.
5. Remove the shaft and bearing assembly from the outboard bearing housing, by removing the internal retaining ring. Lightly tap the outboard shaft end with a soft-headed mallet until the outboard bearing clears the bearing housing.
6. Remove the outboard bearing from the shaft by disengaging the tang on the lock-washer from the lock-nut, and then remove the lock-nut with a bearing lock-nut wrench or by tapping the groove in the lock-nut with a hammer and drift. The bearing can now be pressed from the shaft.
7. Remove the internal retaining ring from the shaft.
8. Remove the inboard bearing by pressing from the shaft. Protect the impeller threads and coupling end of the shaft from damage when pressing bearings off the shaft.





- 9A. If the bearing frame is provided with labyrinth type oil seals, and they are still in good condition they can remain in the bearing frame and bearing housing. If replacement is necessary they can be pressed out of their respective housings.
- 9B. If the bearing frame is provided with lip type oil seals, remove the oil seals from the outboard bearing housing and from the power-frame. These seals are removed by lightly tapping with a soft-headed mallet.

**NOTE: These seals should not be reused after disassembly.**

10. Remove the o-ring seal from the bearing housing.

11. If separate, remove the bearing frame adapter screws and remove the adapter. Remove the casing jack-screws from the adapter.
12. If separate, remove the frame-leg screws and remove the frame-leg.
13. Remove the sight-glass, breather and plugs from their respective locations.

## POWER-FRAME ASSEMBLY

Refer to the following table for torque values while reassembling the pump.

Recommended Fastener Torque					
Fastener(s)	Item No.	Recommended Torque ft-lbs (N-m)			
		Group I	Group II		Group III
Casing	356A	10 (13.6)	1/2 - 13UNC	20 (27.2)	35 (47.6)
			5/8 - 11UNC	35 (47.6)	
Gland	353	10 (13.6)	10 (13.6)		15 (20.4)
Frame Foot	370F	N.A.	25 (34)		60 (81.6)
Adjusting Bolt	370D	10 (13.6)	25 (34)		40 (54.4)
Adapter	N/A	N/A	25 (34)		40 (54.4)

1. Clean and visually inspect all parts prior to reassembly. Particularly note condition of shaft surfaces and housing bores where oil seals contact.
2. Evenly heat bearings up to 167°F (75°C) above room temperature, approximately 239°F (115°C).



### CAUTION

*Do not exceed 257°F (125°C) as damage to the bearings may occur.*



### CAUTION

*Since the shaft is typically made of stainless steel, pressing the bearings on the shaft may result in damage to the shaft.*

3. Note orientation of bearings before installing on shaft:  
  
 Outboard Bearing (coupling end) – If bearing contains ball filling slots, the slots should be facing the coupling (key-way) end of shaft. If the bearing has a single shield, the shield faces toward the coupling end of the

shaft. If the pump is provided with re-greasable bearings, the bearing grease shield should face the impeller (threaded) end of shaft.

Inboard Bearing (impeller end) – If bearing contains ball filling slots, the slots should be facing the coupling (key-way) end of shaft. If the bearing has a single shield, the shield faces toward the threaded end of the shaft. If the pump is provided with re-greasable bearings, the bearing grease shield should face the coupling (key-way) end of shaft.

4. Install the outboard bearing on the shaft by sliding it over the key-way end of the shaft until it is seated squarely against the shaft shoulder.
5. Place the retaining ring over the shaft before installing the inboard bearing, as this is impossible to install later.
6. Install the inboard bearing on the shaft by sliding it over the threaded end of the shaft until it is seated squarely against the shaft shoulder.
7. Install the lock-washer and lock-nut against the outboard bearing and then tighten the lock-nut with a bearing lock-nut wrench or by tapping the groove in the lock-nut with a hammer and drift. The lock-nut can then be secured by bending the tang on the lock-washer into the groove on the lock-nut. Be careful not to mar the oil seal surfaces of the shaft which are in close proximity to the bearings and lock-nut.
8. Install the o-ring seal on the bearing housing.
9. If the bearing frame is provided with labyrinth type oil seals, lubricate the seal o-rings and press fit the labyrinth seals into the bearing housing and bearing frame bores.

10. Install the shaft and bearing assembly into the bearing housing, by first lubricating the bore with some oil and then sliding in the shaft assembly. Lightly tap the bearing housing with a soft-headed mallet until the outboard bearing clears the retaining ring groove. Using snap-ring pliers install the retaining ring with the opening in the ring lining up with the oil return slot in the bearing housing.
11. If the bearing frame is provided with lip type oil seals, install the outboard oil seal into the bearing housing. Lubricate the ID of the seal and place sealant around the OD of the seal. Carefully place the oil-seal over the shaft watching out for sharp edges such as on key-ways and place up against the bore. Seat the oil-seal in place with a soft-faced tool applying force evenly around the outer edge to avoid cocking the seal. Wipe off any excess sealant.
12. The shaft assembly is now ready for installation. Ensure that the power-frame is free of contaminants and then lubricate the bores in the power-frame with oil to ease installation. Line up the shaft assembly so the oil-drain slot in the bearing housing is facing down and slide the shaft assembly into the power-frame as far as it will go by hand. Check to be sure the assembly is going in straight. Lightly tap the key-way end of the shaft to assure the shaft is in its forward most position. Be careful not to pinch the bearing housing o-ring seal on the power-frame, or damage the o-ring in the labyrinth oil seal.
13. Install the adjusting screws. If screws are of different length, the longer screws thread into the power-frame.
14. Install the inboard lip type oil seal, if required into the power-frame. First ensure that the bore and shaft diameter are clean and free of scratches or grooves. Lubricate the ID of the seal and place sealant around the OD of the seal. Carefully place the oil-seal over the shaft watching out for sharp edges such as on impeller threads and place up against the bore. Then seat the oil-seal in place with a soft-faced tool applying force evenly around the outer edge to avoid cocking the seal. Wipe off any excess sealant.
15. Install the deflector, if bearing frame is provided with lip type oil seals, by sliding on the shaft.
16. Install sight-glass, breather and plugs in their respective locations.
17. If separate, install the frame-leg and secure with frame-leg screws, torque to 25 ft-lbs.
18. If separate, install the bearing frame adapter. Ensure that the adapter is seated squarely on the power-frame before tightening adapter screws, this may require some sanding of the paint on the pilot diameters. Secure with adapter screws, torque to 25 ft-lbs.
19. Install the casing jack-screws, ensure that the screws do not extend past the cast iron cover adapter, as damage could result to the pump.



## CAUTION

*Prior to starting the pump, re-lubricate the bearing frame.*

## PUMP END ASSEMBLY

1. Inspect casing, cover and impeller for any damage and make sure all sealing surfaces are free of dirt and scratches. If pump is equipped with an internal seal flush, make sure cover flush hole is clear.
2. Use the adjusting screws to adjust the bearing housing to its forward most position and then lightly coat the shaft threads with an anti-seize compound.
3. The 4150 pump, as standard, is equipped with a single outside seal with stationary seal face and rotating compression unit, or a double inside seal with stationary seal faces and rotating double seal compression unit. The following installation instructions are based on these seal types. When other types of seals are used, please refer to the manufacturer's installation data. Determine the type of seal being used and refer to the following sections.

# SINGLE OUTSIDE SEAL INSTALLATION JOHN CRANE TYPE 8B2

1. Remove the mechanical seal from its packaging, inspect for any damage, and keep seal faces clean and free from contaminants during installation.



## CAUTION

**DO NOT GREASE OR LUBRICATE SEAL FACES.**

2. Install the inboard stationary seal gasket and the stationary seal insert into their bores on the pump cover. Then place the outboard stationary gasket over the stationary insert. Next place the seal gland over the stationary insert and gaskets, making sure that all the gaskets have been installed properly before securing the gland bolts. Be sure that the gland pilot is properly engaged, and draw up the gland bolts evenly, cross staggering adjustment of the bolts. Proper gland bolt adjustment is especially important where clamp style inserts are used. The gland bolts should be torqued to a maximum of 10 Ft/Lbs.
3. Lightly coat the impeller sleeve with a suitable lubricant. Carefully slide impeller sleeve through the cover, being careful not to chip the stationary sealing face.
- 3A. For separate shaft sleeve installation, position the cover over the impeller and insert the sleeve through the mechanical seal stationary insert until the hooked end of the sleeve rests on the impeller hub.
4. Lubricate the rotary unit o-ring with a suitable lubricant. Then engage the rotary assembly over the impeller sleeve. Use a slight twisting motion as the rotary unit is slid down the impeller sleeve until it touches the stationary sealing face. Do not tighten set screws or remove setting clips.

5. Mount the impeller, cover and seal assembly onto the power-frame, making sure the impeller threads are firmly bottomed on the shaft threads.
- 5A. For separate shaft sleeve installation, slide the sleeve and seal assembly over the shaft until the hooked end of the sleeve bottoms on the shaft shoulder. Install and clamp cover in position. Insert impeller o-ring in the groove on the impeller hub and thread impeller onto shaft insuring impeller hub, sleeve hook and shaft shoulder are firmly bottomed.
6. At this stage, check to be sure the impeller threads are properly seated on the shaft threads. There should be clearance between the cover face and the back of the impeller. If there is no clearance, adjust the shaft forward with the adjusting screws and reseal the impeller.
7. With the impeller threads firmly seated, adjust the impeller towards the cover until the back of the impeller just touches the cover face.
8. Install the cover o-ring and casing. Adjust the axial impeller clearance to the specified value in the *Impeller Clearance* section.
9. Slide the seal rotary unit until it touches the seal stationary face with a slight twisting motion. Tighten the rotary set screws and remove the assembly clips. No further seal adjustment is necessary.
10. Make appropriate piping connections to the seal assembly.

# DOUBLE SEAL INSTALLATION JOHN CRANE TYPE 8-1T

1. Remove the mechanical seal from its packaging, inspect for any damage, keep seal faces clean and free from contaminants during installation.



## CAUTION

**DO NOT GREASE OR LUBRICATE SEAL FACES.**

2. Lightly lubricate the inboard stationary insert o-ring and cover bore with a suitable lubricant and then install the inboard stationary insert into the pump cover bore.
3. Lightly lubricate the outboard stationary, insert o-ring

and gland bore, and install the outboard stationary into the gland bore.

4. Lightly coat the impeller sleeve with a suitable lubricant. Carefully slide impeller sleeve through the cover, being careful not to chip the stationary sealing face.
- 4A. For separate shaft sleeve installation, position the cover over the impeller and insert the sleeve through the mechanical seal stationary insert until the hooked end of the sleeve rests on the impeller hub.

5. Lubricate the rotary unit o-rings with a suitable lubricant. Then engage the rotary assembly over the impeller sleeve. Use a slight twisting motion as the rotary unit is slid down the impeller sleeve until it touches the stationary sealing face. Do not tighten set screws.
6. Install the gland o-ring into its groove on the gland. Then place the gland over the rotating seal assembly, making sure the gland o-ring is in place before securing the gland bolts. Be sure that the gland pilot is properly engaged, and draw up the gland bolts evenly, cross staggering adjustment of the bolts. The gland bolts should be torqued to a maximum of 10 Ft/Lbs.
7. Mount the impeller, cover and seal assembly onto the power-frame, making sure the impeller threads are firmly bottomed on the shaft threads.
- 7A. For separate shaft sleeve installation, slide the sleeve, gland and cover assembly over the shaft until the hooked end of the sleeve bottoms on the shaft shoulder. Clamp cover in position. Insert impeller o-ring in the groove on the impeller hub and thread impeller onto shaft insuring impeller hub, sleeve hook, and shaft shoulder are firmly bottomed.
8. At this stage, check to be sure the impeller threads are properly seated on the shaft threads. There should be clearance between the cover face and the back of the impeller. If there is no clearance, adjust the shaft forward with the adjusting screws and reseal the impeller.
9. With the impeller threads firmly seated, adjust the impeller towards the cover until the back of the impeller just touches the cover face.
10. Install the cover o-ring and casing. Adjust the axial impeller clearance to the specified value in the *Impeller Clearance* section.
11. Remove the pipe plug in the bottom of the gland. Center the set screws of the seal rotary unit in the pipe plug hole and tighten. Replace pipe plug and make appropriate piping connections to the seal assembly.

## DOUBLE SEAL INSTALLATION

### JOHN CRANE TYPE 8-D

1. Remove the mechanical seal from its packaging, inspect for any damage, keep seal faces clean and free from contaminants during installation.



#### CAUTION

***DO NOT GREASE OR LUBRICATE SEAL FACES.***

2. Lightly lubricate the inboard stationary insert o-ring and cover bore and install the inboard stationary insert into the pump cover bore.
3. Lightly lubricate the outboard stationary insert o-ring and gland bore and install the outboard stationary insert into the gland bore.
4. Lightly coat the impeller sleeve with a suitable lubricant. Carefully slide impeller sleeve through the cover, being careful not to chip the stationary sealing face.

***NOTE: The John Crane 8-D is a friction drive type of seal. The impeller sleeve and rotary unit should be lubricated with a soapy water solution to ease installation without reducing the frictional drive of the rotary unit.***

- 4A. For separate shaft sleeve installation, position the cover over the impeller and insert the sleeve through the mechanical seal stationary insert until the hooked end of the sleeve rests on the impeller hub.
5. Lubricate the rotary unit o-rings with a suitable lubricant. Then engage the rotary assembly over the impeller sleeve. Use a slight twisting motion as the rotary unit is slid down the impeller sleeve until it touches the stationary sealing face.
6. Install the gland o-ring into its groove on the gland. Then place the gland over the rotating seal assembly, making sure the gland o-ring is in place before securing the gland bolts. Be sure that the gland pilot is properly engaged, and draw up the gland bolts evenly, cross staggering adjustment of the bolts. The gland bolts should be torqued to a maximum of 10 Ft/Lbs.
7. Mount the impeller, cover and seal assembly onto the power-frame, making sure the impeller threads are firmly bottomed on the shaft threads.

- 7A. For separate shaft sleeve installation, slide the sleeve, gland, and cover assembly over the shaft until the hooked end of the sleeve bottoms on the shaft shoulder. Clamp cover in position. Insert impeller o-ring in the groove on the impeller hub and thread impeller onto shaft insuring impeller hub, sleeve hook, and shaft shoulder are firmly bottomed.
8. At this stage, check to be sure the impeller threads are properly seated on the shaft threads. There should be clearance between the cover face and the back of the impeller. If there is no clearance, adjust the shaft forward with the adjusting screws and reseal the impeller.
9. With the impeller threads firmly seated, adjust the impeller towards the cover until the back of the impeller just touches the cover face.
10. Install the cover o-ring and casing. Adjust the axial impeller clearance to the specified value in the *Impeller Clearance* section.
11. The 8-D seal is self centering and requires no adjustment. Make appropriate piping connections to the seal assembly.

## PACKED STUFFING BOX

1. Install the four gland studs into the cover and tighten to 10 ft-lbs.
2. Install o-ring in stuffing box extension. Place over gland studs and check that the stuffing box extension is seated properly. Secure to cover with gland nuts and washers, tighten to 10 ft-lbs.
3. Place metallic shaft sleeve in cover bore, and install two packing rings into the stuffing box extension. Install the lantern ring followed by remaining three packing rings.
4. Check to make sure lantern ring is lined up with flush hole. Damage could result to packing and shaft sleeve if flush water is restricted.
5. Install gland ring over gland studs and secure with gland nuts and washers. Hand-tighten the nuts for now. The nuts need to be adjusted when the pump is started up.
6. Mount the cover assembly and sleeve onto the power-frame.
7. Clamp the cover in position and slide the shaft sleeve towards the bearing frame until it bottoms on the shaft shoulder. Insert impeller o-ring in the groove on the impeller hub and thread impeller onto shaft insuring impeller hub, sleeve and shaft shoulder are firmly bottomed.
8. At this stage, check to be sure the impeller threads are properly seated on the shaft threads. There should be clearance between the cover face and the back of the impeller. If there is no clearance, adjust the shaft forward with the adjusting screws and reseal the impeller.
9. With the impeller threads firmly seated, adjust the impeller towards the cover until the back of the impeller just touches the cover face.
10. Install the cover o-ring and casing. Adjust the axial impeller clearance to the specified value in the *Impeller Clearance* section.
11. Make appropriate flush piping connections to the stuffing box extension.

## IMPELLER CLEARANCE SETTING



### WARNING

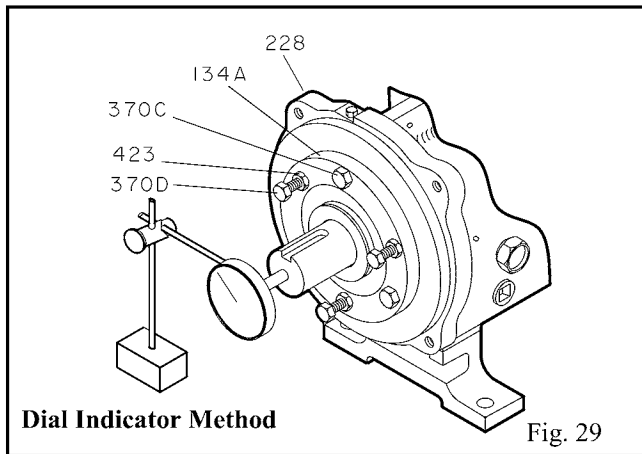
***Lock out driver power to prevent accidental startup and physical injury.***

A change in pump performance may be noted over time by a drop in head or flow or an increase in power required. Performance can usually be renewed by adjusting the impeller clearance. Two techniques are given to set the impeller clearance, the dial indicator method and the feeler gauge method.

### DIAL INDICATOR METHOD

1. Remove coupling guard. Refer to coupling guard instructions *Appendix I*.
2. Remove coupling.
3. Set indicator so that button contacts either the shaft end or against face of coupling (Fig. 29).
4. Loosen jam nuts (423) on jack bolts (370D) and back bolts out about two turns.

- Tighten each locking bolt (370C) evenly, drawing the bearing housing (134A) towards the bearing frame (228) until impeller contacts the casing. Turn the shaft to ensure contact is made.

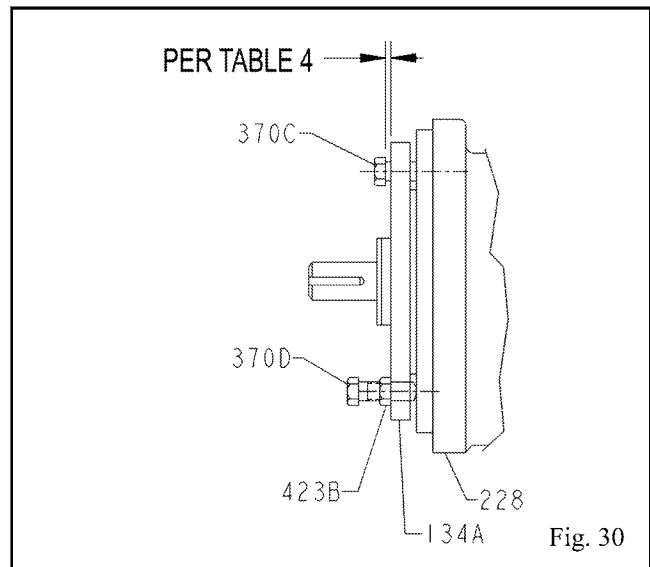


- Set indicator to zero and back locking bolt (370C) out about one turn.
- Thread jack bolts (370D) in until they evenly contact the bearing frame. Tighten the jack bolts evenly (about one flat at a time) backing the bearing housing (134A) away from the bearing frame until the indicator shows the proper clearance per *Table 4*.
- Evenly tighten locking bolts (370C), then jack bolts (370D) keeping indicator reading at proper setting.
- Check shaft for free turning.
- Replace coupling guard.

## FEELER GAUGE METHOD

- Remove coupling guard. Refer to coupling guard instructions in *Appendix I*.
- Loosen jam nuts (423) on jack bolts (371A) and back bolts out about two turns (Fig. 30).
- Tighten locking bolts (370C) evenly, drawing bearing housing (134A) towards frame (228) until impeller contacts the casing. Turn shaft to ensure contact is made.
- Using a feeler gauge, set the gap between the three locking bolts (370C) and bearing housing (134A) per impeller clearances in *Table 4*.
- Evenly back out bearing housing (134A) using the three jack bolts (370D) until it contacts the locking bolts (370C). Evenly tighten jam nuts (423B).

- Check shaft for free turning.
- Replace coupling guard.

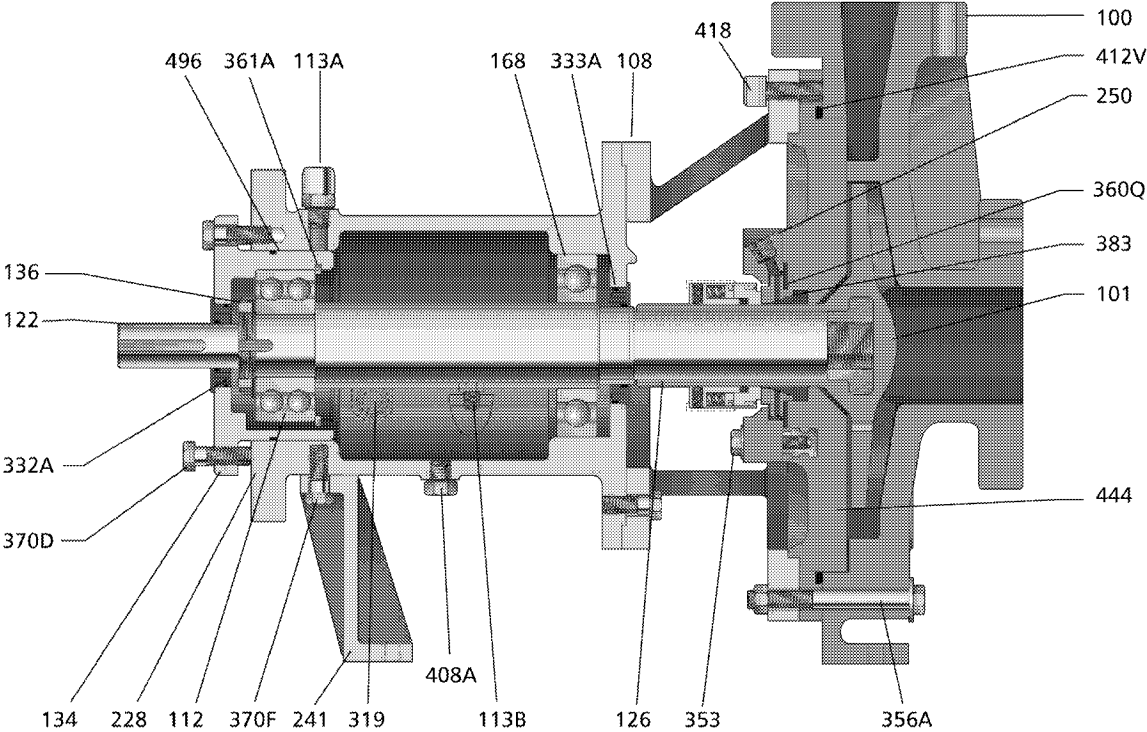


Impeller diameter (inches)	Clearance (inches)	Clearance (mm)
up to 8	0.015	0.381
8.125 to 10	0.020	0.508
10.125 to 16	0.025	0.635

# ASSEMBLY TROUBLESHOOTING

Symptom	Cause	Remedy
Excessive shaft end play.	Bearing internal clearance too great.	Replace bearings with correct type.
	Snap ring loose in bearing housing groove.	Reseat.
Excessive shaft/sleeve runout.	Sleeve worn.	Replace
	Shaft bent.	Replace.
Excessive bearing frame flange runout.	Shaft bent.	Replace
	Bearing frame flange distorted.	Replace.
Excessive frame adapter runout.	Corrosion.	Replace.
	Adapter to frame gasket not seated properly.	Reseat.
Excessive seal chamber/stuffing box cover runout.	Seal chamber/stuffing box cover not properly seated in frame adapter.	Replace.
	Corrosion or wear.	
Excessive impeller vane tip runout.	Bent vane(s).	Replace impeller.

# 4150 Cross Sectional





## 4150 Materials Of Construction

Item No.	Part Name	Material
100	Casing	Fiberglass Reinforced Vinyl Ester
101	Impeller	Fiberglass Reinforced Vinyl Ester
108	Adapter	Cast Iron
112	Thrust Bearing	Steel
113A	Breather	Steel
113B	Fill Plug	Steel
122	Shaft	316 SS
126	Journal Sleeve (Optional) not shown	316SS
134	Bearing Housing	Cast Iron
136	Bearing Locknut and Washer	Steel
168	Radial Bearing	Single Row Deep Groove
228	Bearing Frame	Cast Iron
241	Frame Foot	Cast Iron
250	Gland	Fiberglass Reinforced Vinyl Ester
319	Oil Sight Glass	Steel / Glass
332A	Labyrinth Seal (Outboard)	Nickel Plated Bronze
333A	Labyrinth Seal (Inboard)	Nickel Plated Bronze
353	Bolt-Gland to Casing	303SS
356A	Bolt-Casing to Frame or Frame Adapter	303SS
360Q	Gland Gasket	Viton
361A	Snap Ring	Steel
370F	Bolt-Foot to Frame	Steel
383	Mechanical Seal	Carbon / Ceramic
408A	Drain Plug	Steel
412A	O-ring - Impeller (when provided)	Viton
412V	O-ring - Casing/Backplate	Viton
418	Jacking Bolt	303SS
444	Backplate	Fiberglass Reinforced Vinyl Ester
496	O-ring - Bearing Housing	Buna



# SPARE PARTS

**RECOMMENDED SPARE PARTS . . . . . 53**  
**HOW TO ORDER . . . . . 53**  
**EMERGENCY SERVICE . . . . . 54**  
**INTERCHANGEABILITY . . . . . 54**

When ordering spare parts, always state Goulds Serial No. and indicate part name and item number from relevant sectional drawing. It is imperative for service reliability to have a sufficient stock of readily available spares.

## RECOMMENDED SPARE PARTS

- Impeller (101)
- Shaft (122A)
- Shaft Sleeve (126)
- Outboard Bearing (112A)
- Inboard Bearing (168A)
- Casing Gasket (351)
- Frame-to-Adapter Gasket (360D)
- Bearing Housing Retaining Ring (361A)
- Bearing Lockwasher (382)
- Bearing Locknut (136)
- Impeller O-Ring (412A)
- Bearing Housing O-Ring (496)
- Outboard Labyrinth Seal Rotary O-Ring (497F)
- Outboard Labyrinth Seal Stationary O-Ring (497G)
- Inboard Labyrinth Seal Rotary O-Ring (497H)
- Inboard Labyrinth Seal Stationary O-Ring (497J)
- Lantern Ring Half (105) (Packed Stuffing Box)
- Stuffing Box Packing (106) (Packed Stuffing Box)
- Packing Gland (107) (Packed Stuffing Box)

7

## HOW TO ORDER

**When ordering parts call  
 1-800-446-8537  
 or your local Goulds Representative**

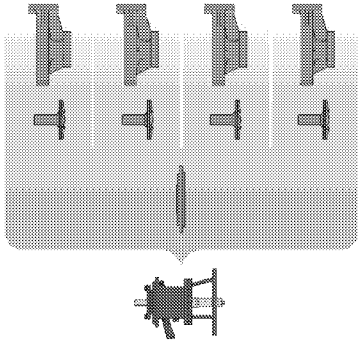
## EMERGENCY SERVICE

**Emergency parts service is available  
 24 hours/day, 365 days/year . . .  
 Call 1-800-446-8537**

# INTERCHANGEABILITY

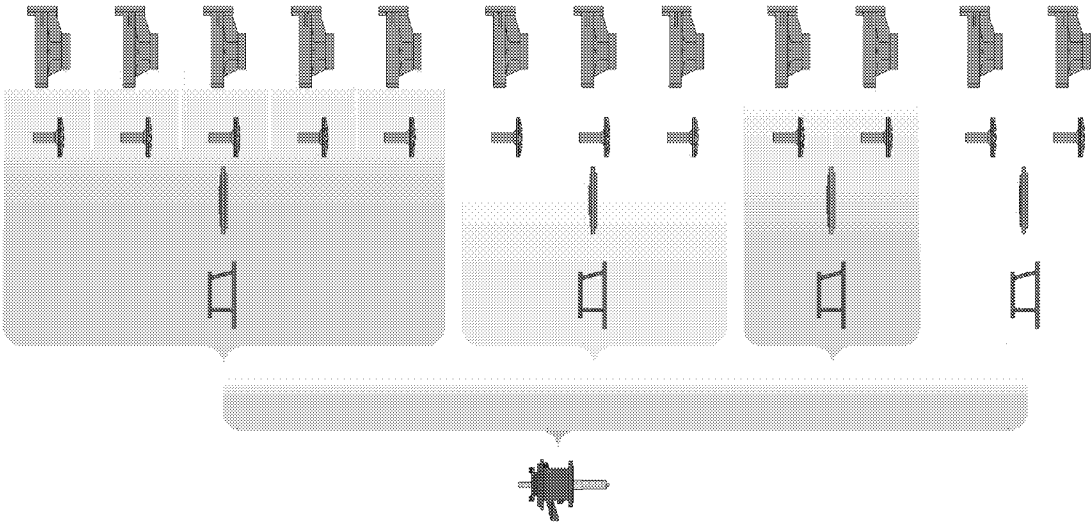
## Group I Pumps

1x1½-6    1½x3-6    2x3-6    1x1½-8



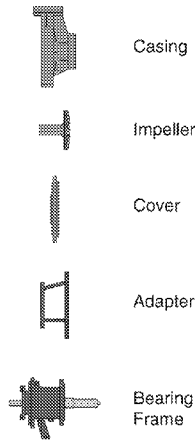
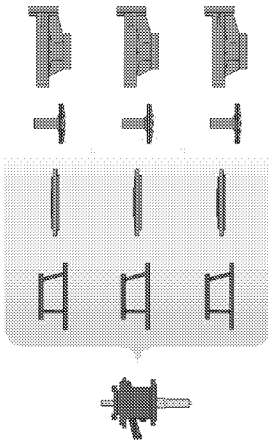
## Group II Pumps

1½ x3-8    2x3-8    3x4-8    1x2-10    1½x3-10    2x3-10    3x4-10    4x4-10    4x6-10    4x6-13    2x3-13    3x4-13



## Group III Pumps

6x8-13    8x10-15    10x12-16



# APPENDIX I

APPENDIX I - INSTALLATION INSTRUCTIONS FOR . . . . . 55  
 GOULDS ANSI B15.1 COUPLING GUARDS  
 APPENDIX II - ALIGNMENT . . . . . 59  
 APPENDIX III - SEAL AND STUFFING BOX ARRANGEMENTS . . . . . 63

## Installation Instructions for Goulds ANSI B15.1 Coupling Guards

The coupling guard used in an ATEX classified environment must be constructed from a non-sparking material.



### WARNING

*Before assembly or disassembly of the coupling guard is performed, the motor must be de-energized, the motor controller/starter put in a locked-out position, and a caution tag placed at the starter indicating the disconnect. Replace coupling guard before resuming normal operation of the pump. Goulds Pumps assumes no liability for avoiding this practice.*

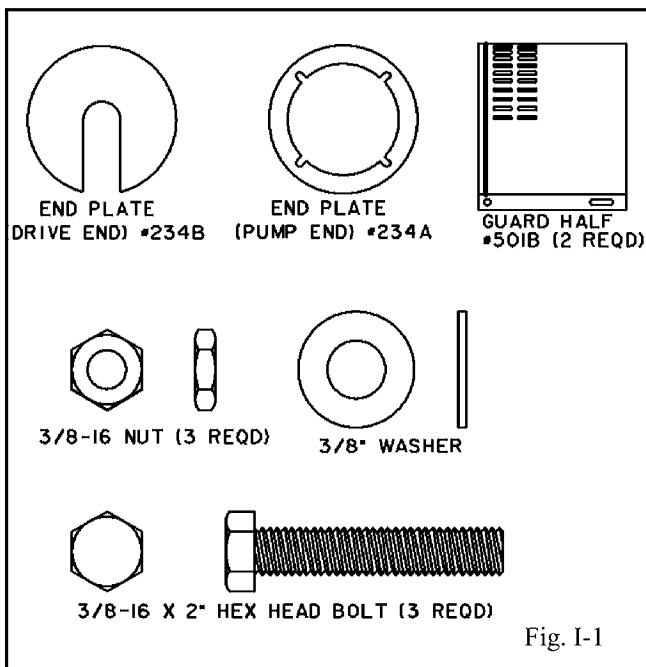


Fig. I-1

Simplicity of design allows complete assembly of the coupling guard, including the end plate (pump end), in about fifteen minutes. If the end plate is already in place, assembly can be accomplished in about five minutes.

### Assembly:

**NOTE:** *If end plate (pump end) is already installed, make any necessary coupling adjustments and then proceed to Step 2.*

1. **Group I & II** - Align end plate (pump end) to the Bearing Frame. (No impeller adjustment required.)

**Group III** - Align the end plate (pump end) to the pump bearing housing so that the large slots on the end plate clear the bearing housing tap bolts and the small slots are aligned to the impeller adjusting bolts. Attach the end plate to the bearing housing using the jam nuts on the impeller adjusting bolts as shown in Fig. I-3.

After the end plate is attached to the bearing housing, the impeller clearance must be checked and reset as explained in the *Preventive Maintenance* section.

**NOTE:** *Coupling adjustments should be completed before proceeding with coupling guard assembly.*

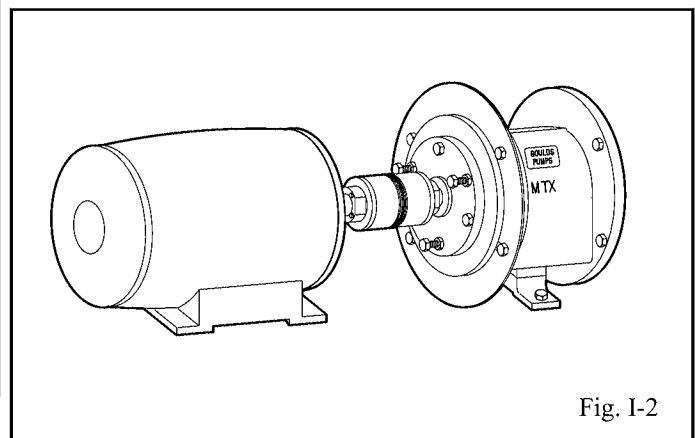
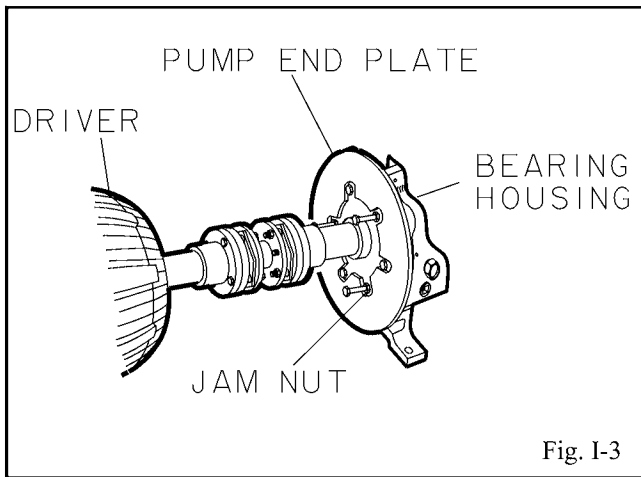
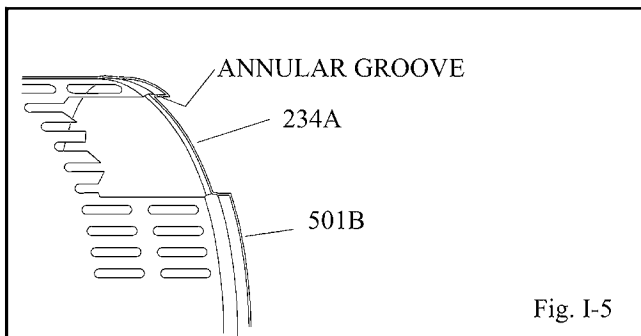
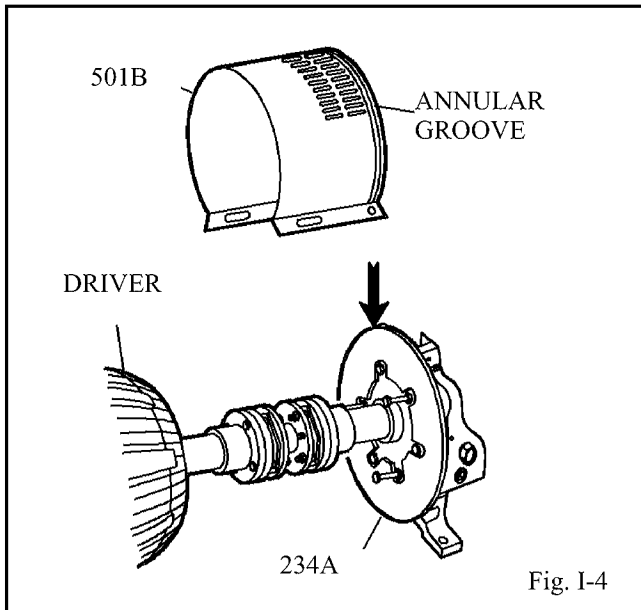


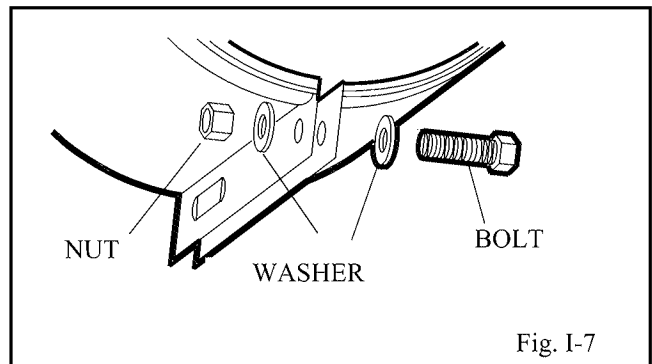
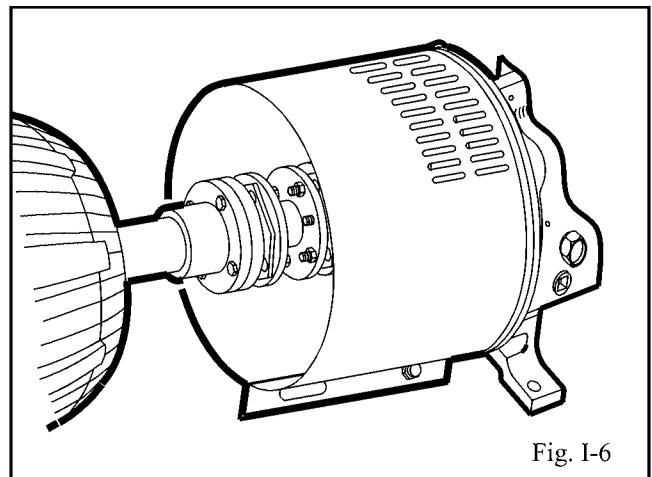
Fig. I-2



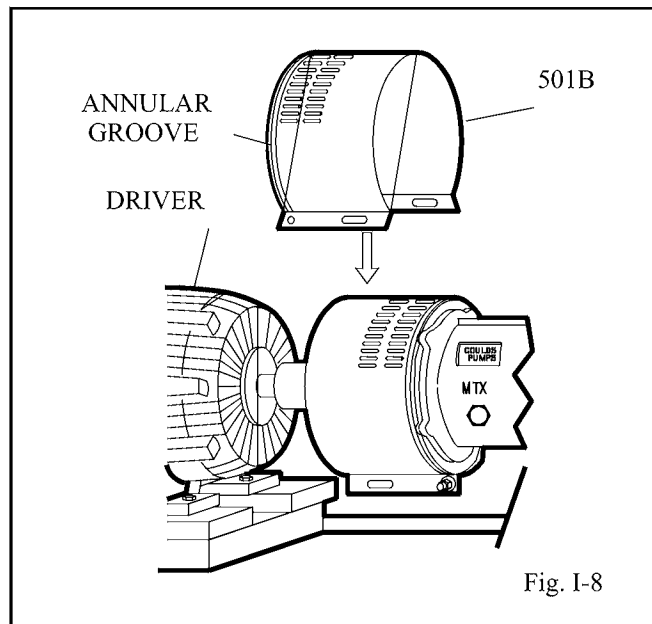
2. Spread bottom of coupling guard half (pump end) slightly and place over pump end plate as shown in Fig. I-4. The annular groove in the guard half is located around the end plate (Fig. I-5).



3. After the coupling guard half (pump end) is located around the end plate, secure it with a bolt, nut and two (2) washers through the round hole at the front end of the guard half as shown in Fig. I-6. Tighten securely (Fig. I-7).



4. Spread bottom of coupling guard half (driver end) slightly and place over coupling guard half (pump end) so that annular groove in coupling guard half (driver end) faces the motor as shown in Fig. I-8.



- Place end plate (driver end) over motor shaft as shown in Fig. I-9. Locate the end plate in the annular groove at the rear of the coupling guard half (driver end) and secure with a bolt, nut, and two (2) washers through the round hole at the rear of the guard half. Finger tighten only.

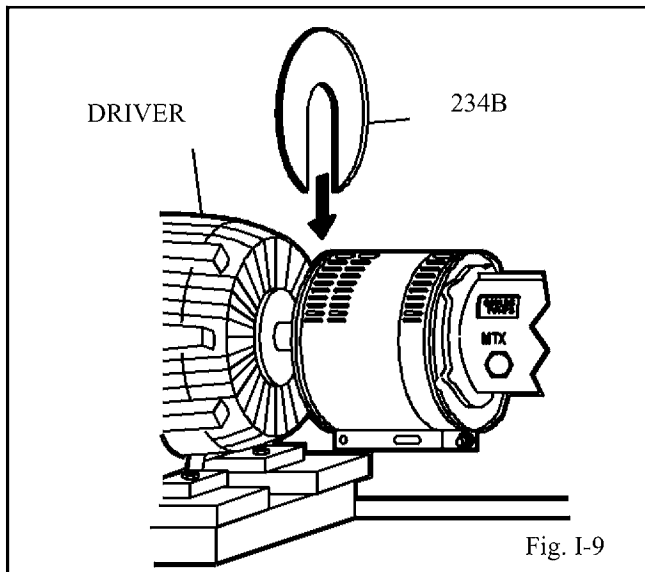


Fig. I-9

- Adjust length of coupling guard to completely cover shafts and coupling as shown in Fig. I-10 by sliding coupling guard half (driver end) towards motor. After adjusting guard length, secure with bolt, nut and two (2) washers through the slotted holes at the center of the guard and tighten. Check all nuts on the guard assembly for tightness.

**ELECTRICAL**

**WARNING**

*Before assembly or disassembly of the coupling guard is performed, the motor must be de-energized, the motor controller/starter put in a locked-out position, and a caution tag placed at the starter indicating the disconnect. Replace coupling guard before resuming normal operation of the pump. Goulds Pumps assumes no liability for avoiding this practice.*

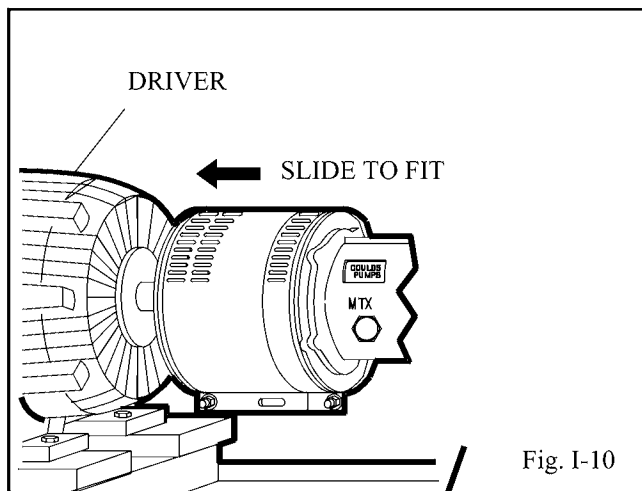


Fig. I-10

## Disassembly

The coupling guard must be removed for certain maintenance and adjustments to the pump such as adjustment of the coupling, impeller clearance adjustment, etc. The coupling guard should be replaced after maintenance is completed.

**WARNING**

*DO NOT resume normal pump operation with the coupling guard removed.*

**NOTE:** Refer to illustrations for assembly in reverse order.

- Remove nut, bolt, and washers from center slotted hole in the coupling guard. Slide motor end coupling guard half towards pump. Fig. I-10.
- Remove nut, bolt, and washers from coupling guard half (driver end), and remove end plate. Fig. I-9.
- Spread bottom of coupling guard half slightly and lift off. Fig. I-8.
- Remove remaining nut, bolt, and washers from coupling guard half (pump end). Spread bottom of coupling guard half slightly and lift off. Fig. I-4.

This completes disassembly of the coupling guard.

**NOTE:** It is not necessary to remove the end plate (pump end) from the pump bearing housing. The bearing housing tap bolts are accessible without removing the end plate in case maintenance of internal pump parts is necessary. Before removing the pump bearing housing, refer to Disassembly & Reassembly section.





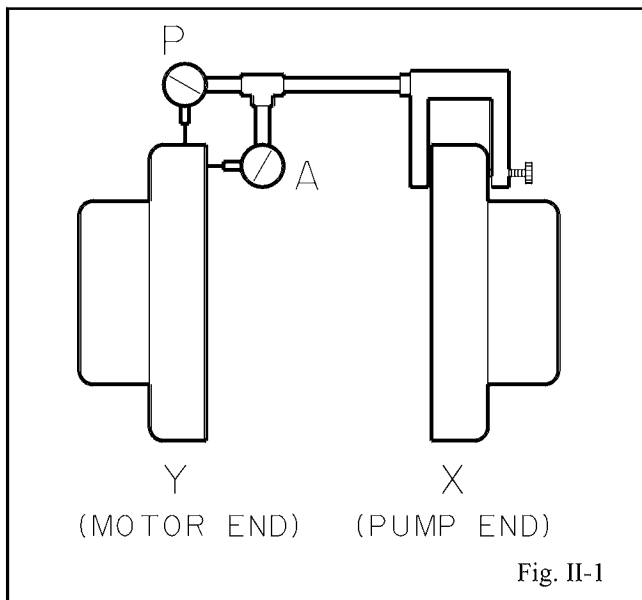
# APPENDIX II

## Alignment

Alignment procedures must be followed to prevent unintended contact of rotating parts. Follow coupling manufacturer's coupling installation and operation procedures.

### SET UP

1. Mount two dial indicators on one of the coupling halves (X) so they contact the other coupling half (Y) (Fig. II-1).
2. Check setting of indicators by rotating coupling half X to ensure indicators stay in contact with coupling half Y but do not bottom out. Adjust indicators accordingly.



### MEASUREMENT

1. To ensure accuracy of indicator readings, always rotate both coupling halves together so indicators contact the same point on coupling half Y. This will eliminate any measurement problems due to runout on coupling half Y.
2. Take indicator measurements with driver feet hold-down bolts tightened. Loosen hold down bolts prior to making alignment corrections.
3. Take care not to damage indicators when moving driver during alignment corrections.

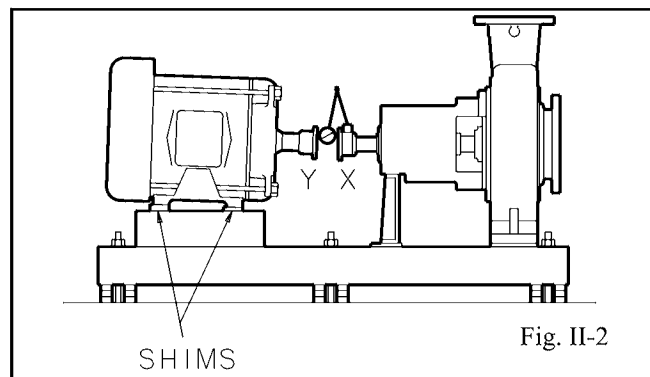
### ANGULAR ALIGNMENT

A unit is in angular alignment when indicator A (Angular indicator) does not vary by more than .002 in. (.05 mm) as measured at four points 90° apart.

#### Vertical Correction (Top-to-Bottom)

1. Zero indicator A at top dead center (12 o'clock) of coupling half Y.
2. Rotate indicators to bottom dead center (6 o'clock). Observe needle and record reading.
3. **Negative Reading** - The coupling halves are further apart at the bottom than at the top. Correct by either raising the driver feet at the shaft end (add shims) or lowering the driver feet at the other end (remove shims) (Fig. II-2).

**Positive Reading** - The coupling halves are closer at the bottom than at the top. Correct by either lowering the driver feet at the shaft end (remove shims) or raising the driver feet at the other end (add shims).



4. Repeat steps 1-3 until indicator A reads .002 in (.05 mm) or less.

#### Horizontal Correction (Side-to-Side)

1. Zero indicator A on left side of coupling half Y, 90° from top dead center (9 o'clock).
2. Rotate indicators through top dead center to the right side, 180° from the start (3 o'clock). Observe needle and record reading.
3. **Negative Reading** - The coupling halves are further apart on the right side than the left. Correct by either sliding the shaft end of the driver to the left or the other end to the right.

3. **Positive Reading** - The coupling halves are closer together on the right side than the left. Correct by either sliding the shaft end of the driver to the right or the other end to the left (Fig. II-3).

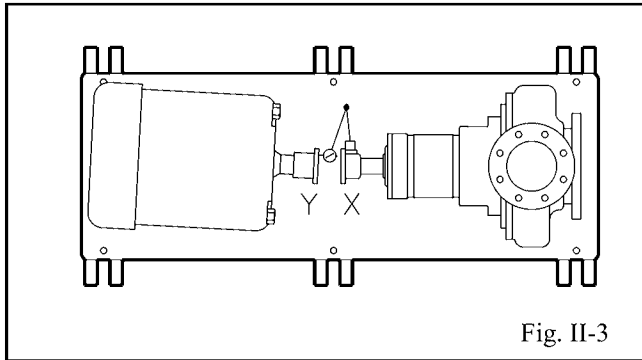


Fig. II-3

4. Repeat steps 1 through 3 until indicator A reads .002 in. (.05 mm) or less.
5. Re-check both horizontal and vertical readings to ensure adjustment of one did not disturb the other. Correct as necessary.

## PARALLEL ALIGNMENT

A unit is in parallel alignment when indicator P (parallel indicator) does not vary by more than .002 in. (.05 mm) as measured at four points 90° apart at operating temperature.

### Vertical Correction (Top-to-Bottom)

1. Zero indicator P at top dead center of coupling (12 o'clock) half Y (Fig. II-1).
2. Rotate indicator to bottom dead center (6 o'clock). Observe needle and record reading.
3. **Negative Reading** - Coupling half X is lower than coupling half Y. Correct by removing shims of thickness equal to half of the indicator reading under each driver foot.

**Positive Reading** - Coupling half X is higher than coupling half Y. Correct by adding shims of thickness equal to half of the indicator reading from each driver foot (Fig. II-4).

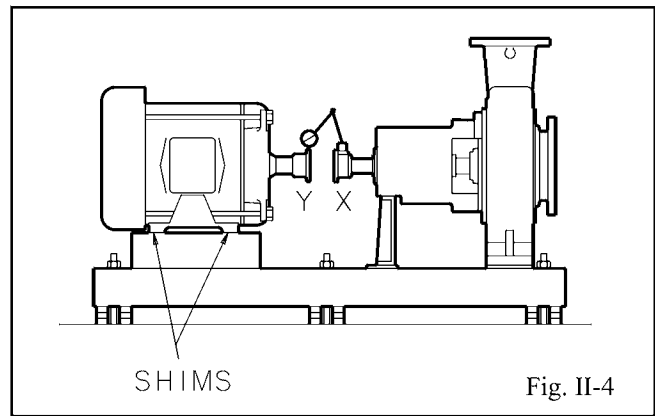


Fig. II-4

**NOTE:** Equal amounts of shims must be added to or removed from each driver foot. Otherwise the vertical angular alignment will be affected.

4. Repeat steps 1 through 3 until indicator P reads within .002 in. (.05 mm) or less when hot.

### Horizontal Correction (Side-to-Side)

1. Zero indicator P on the left side of coupling half Y, 90° from top dead center (9 o'clock).
2. Rotate indicators through top dead center to the right side, 180° from the start (3 o'clock). Observe needle and record reading.
3. **Negative Reading** - Coupling half Y is to the left of coupling half X. Correct by sliding driver evenly in the appropriate direction (Fig. II-5).

**Positive Reading** - Coupling half Y is to the right of coupling half X. Correct by sliding driver evenly in the appropriate direction.

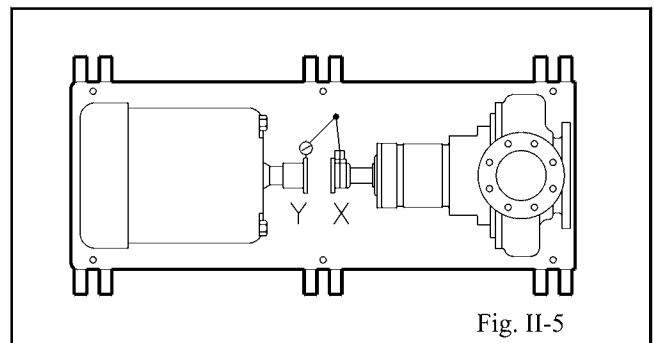


Fig. II-5

**NOTE:** Failure to slide motor evenly will affect horizontal angular correction.

4. Repeat steps 1 through 3 until indicator P reads .002 in. (.05 mm) or less.
5. Re-check both horizontal and vertical readings to ensure adjustment of one did not disturb the other. Correct as necessary.

## COMPLETE ALIGNMENT

A unit is in complete alignment when both indicators A (angular) and P (parallel) do not vary by more than .002 in. (.05 mm) as measured at four points 90° apart.

### Vertical Correction (Top-to-Bottom)

1. Zero indicators A and P at top dead center (12 o'clock) of coupling half Y.
2. Rotate indicator to bottom dead center (6 o'clock). Observe the needles and record the readings.
3. Make corrections as outlined previously.

### Horizontal Correction (Side-to-Side)

1. Zero indicators A and P on the left side of coupling half Y, 90° from top dead center (9 o'clock).
2. Rotate indicators through top dead center to the right side, 180° from the start (3 o'clock). Observe the needle, measure and record the reading.
3. Make corrections as outlined previously.
4. Recheck both vertical and horizontal readings to ensure adjustment of one did not disturb the other. Correct as necessary.

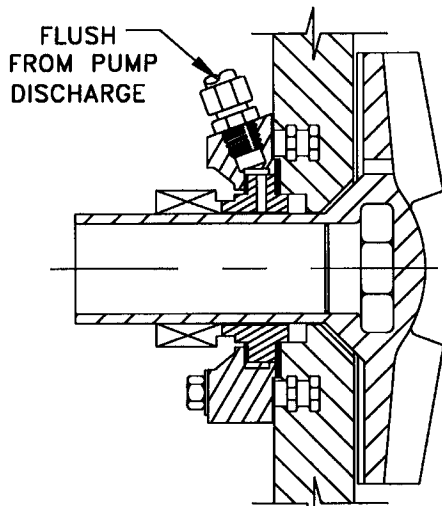
***NOTE: With experience, the installer will understand the interaction between angular and parallel and will make corrections appropriately.***



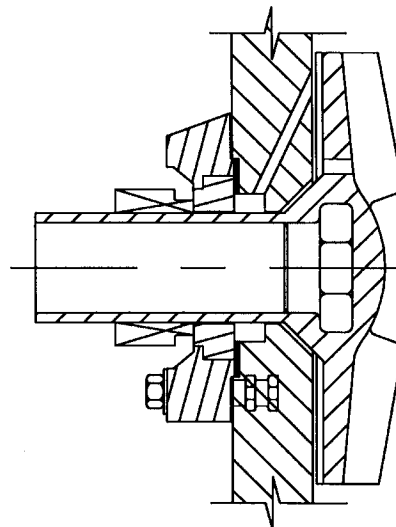
# APPENDIX III

## 4150 SEAL AND STUFFING BOX ARRANGEMENTS

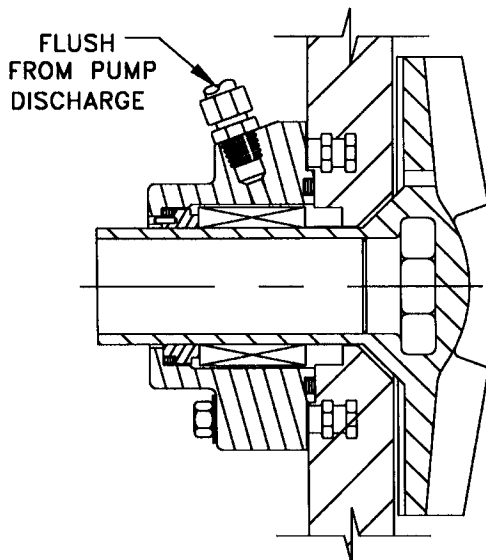
**Product Flush:** A portion of the pumped fluid is re-circulated through the stuffing box to provide lubrication and cooling to the seal. Use plastic fittings only.



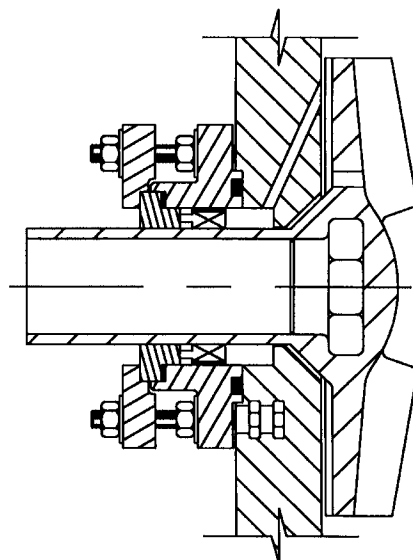
SINGLE OUTSIDE-DRILLED,  
CLAMPED SEAT WITH CASING  
BYPASS FLUSH



SINGLE OUTSIDE-SOLID CLAMPED SEAT  
WITH INTERNAL COVER FLUSH



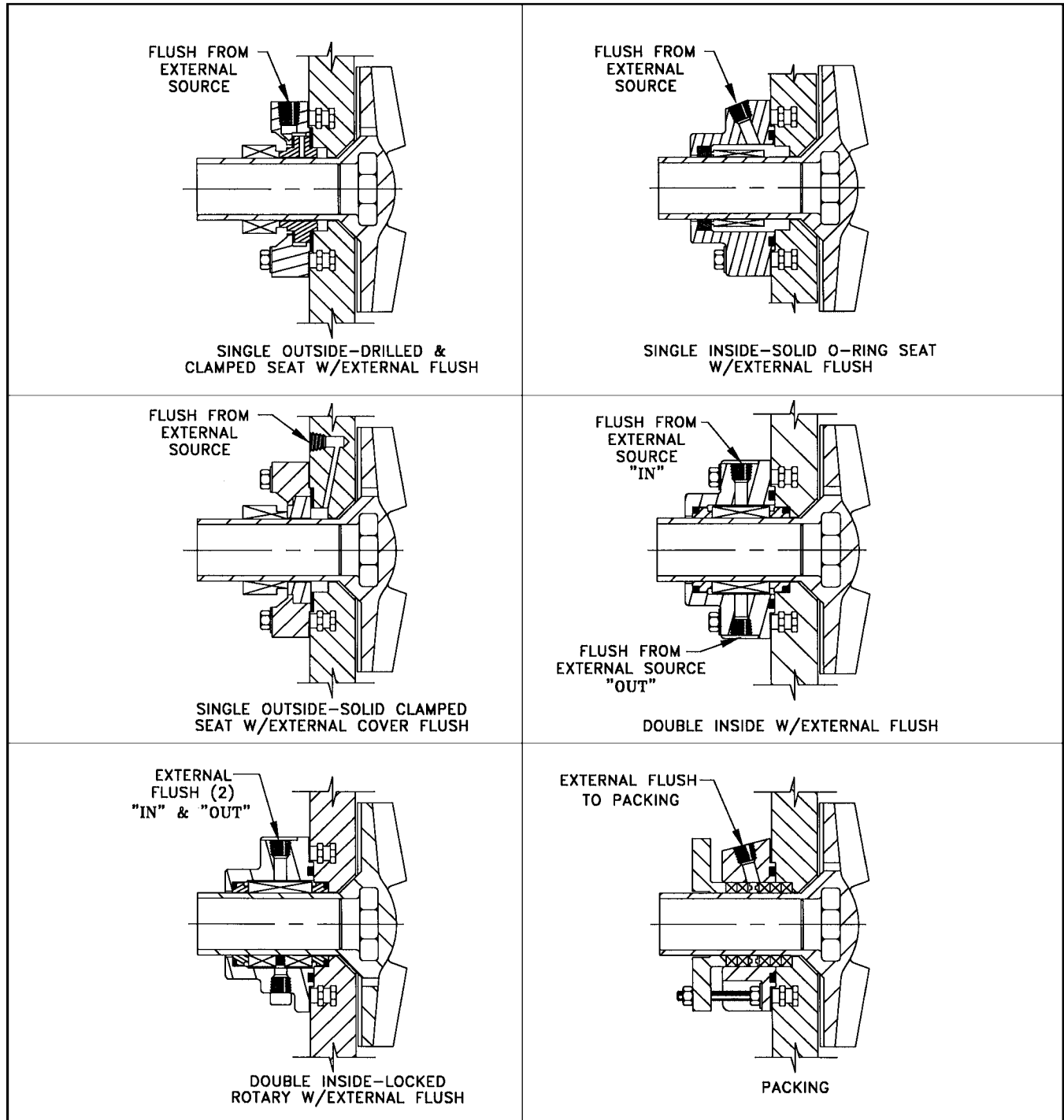
SINGLE INSIDE-SOLID O-RING SEAT  
WITH CASING BYPASS FLUSH



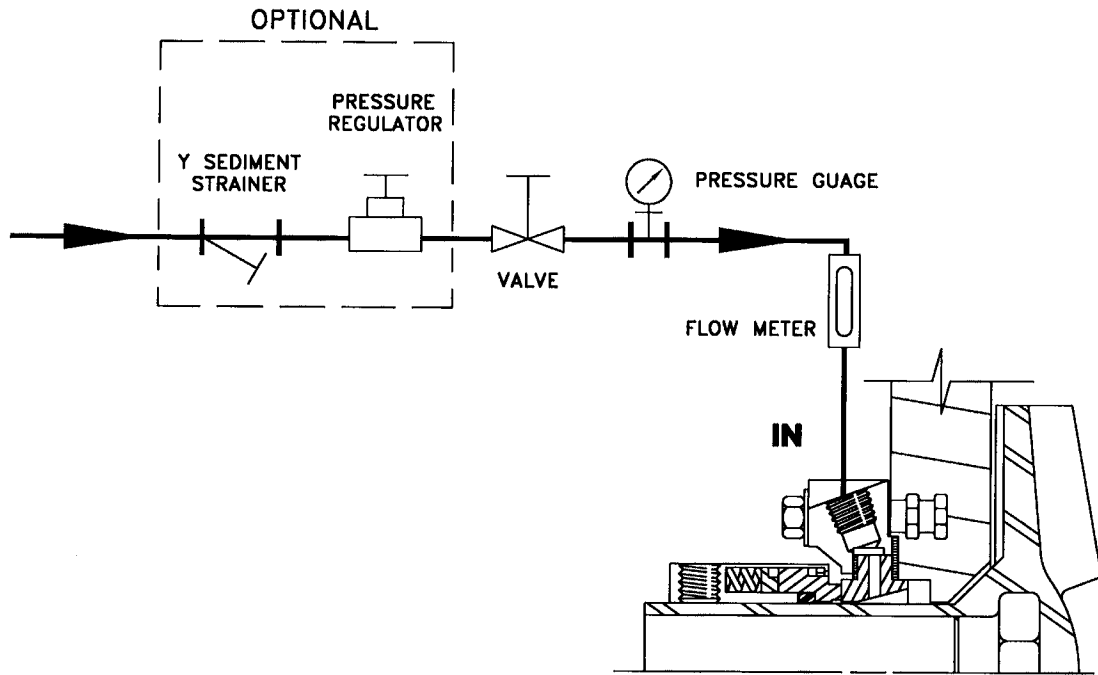
SINGLE INSIDE-SOLID CLAMPED SEAT  
WITH INTERNAL COVER FLUSH

# 4150 SEAL AND STUFFING BOX ARRANGEMENTS

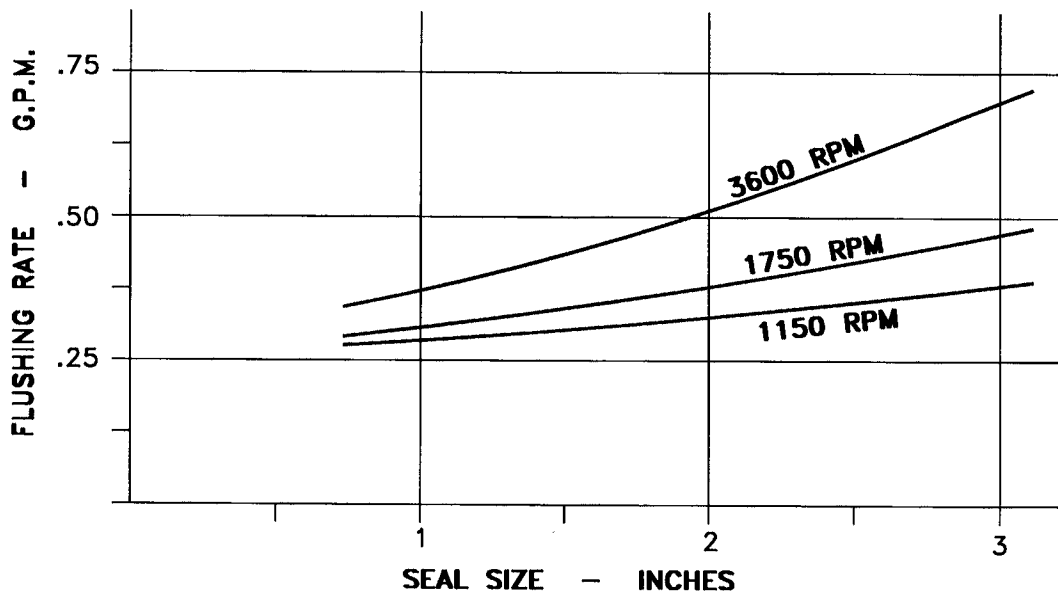
**External Flush:** An external source of clean fluid is required at the stuffing box to provide lubrication and cooling. Use plastic fittings only.



# FLUSH PIPING FOR SINGLE MECHANICAL SEAL

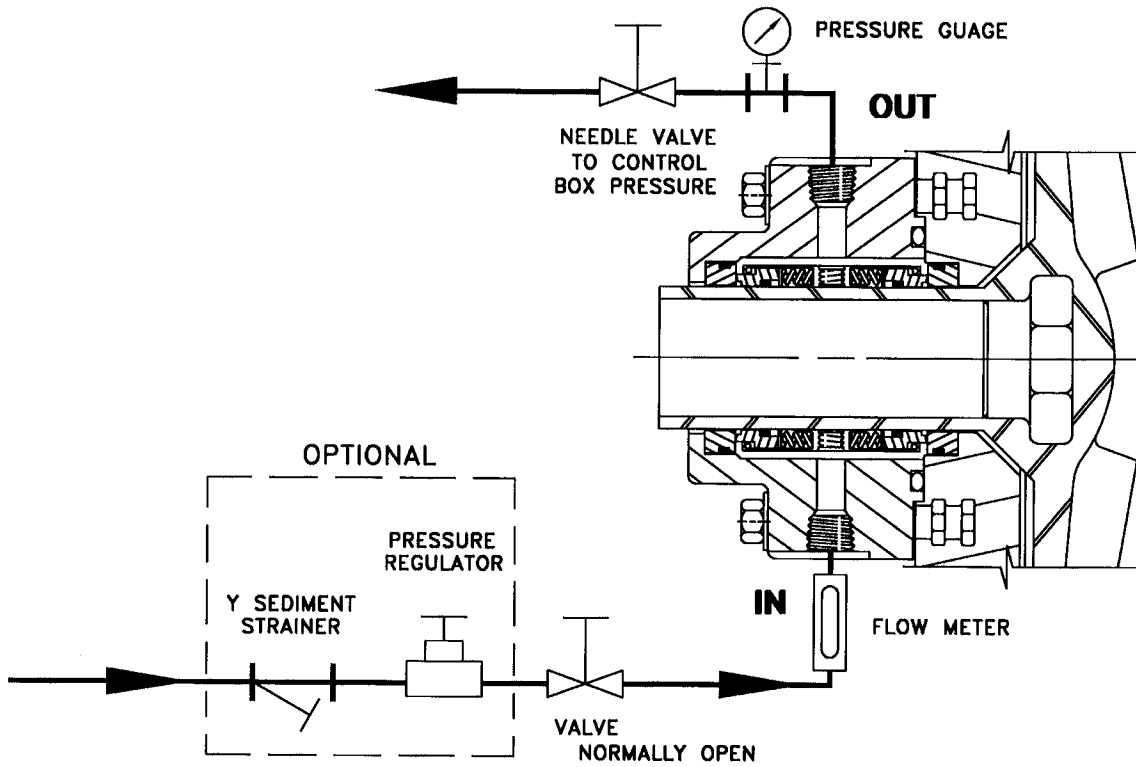


# FLUSH FLOW RATE FOR SINGLE SEAL

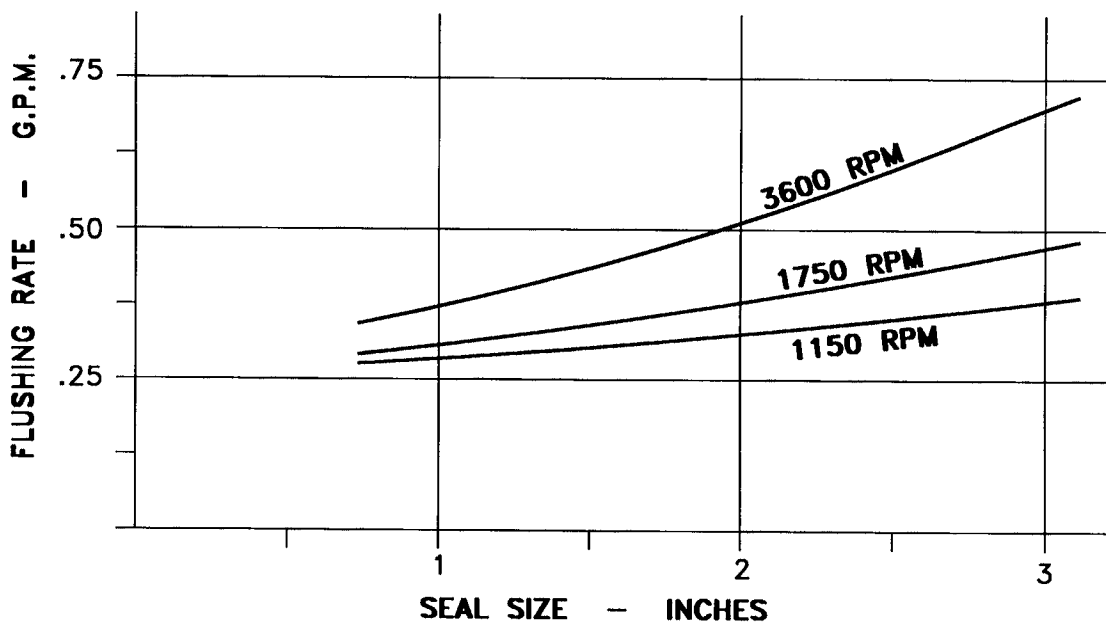


FLUSH PRESSURE - 15 TO 25 PSI ABOVE STUFFING BOX PRESSURE  
 FLUSH LIQUID TEMPERATURE - 125°F (50°C) MAXIMUM

## FLUSH PIPING FOR DOUBLE INSIDE MECHANICAL SEAL



## FLUSH FLOW RATE FOR DOUBLE SEAL



FLUSH PRESSURE - 15 TO 25 PSI ABOVE STUFFING BOX PRESSURE  
 FLUSH LIQUID TEMPERATURE - 125°F (50°C) MAXIMUM

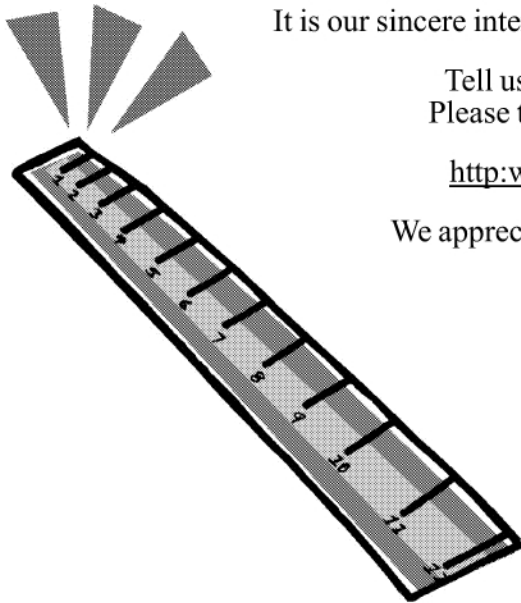








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**ITT**